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CSA B149.3 – 2020 – Major Revisions		
Code title, scope, applications, references and definitions		
Pilot supply take offs		
Manual isolation valves and test firing valves		
Pilots and pilot burners		
Input flow control systems		
Liquid propane valve trains		
Low temperature, multi-fuel burners		
Safety controls		
Rating plate		
Process ovens, process furnaces, atmosphere generators		
Generators, compressors/pressure boosters, engines and turbines		
Flare pilot		
Complex and integrated facility		
Portable appliances and equipment		
Annex I (informative) **Risk based program for determining requirements for an appliance in a complex and integrated facility**		
Annex J (informative) **Mobile outdoor food service unit**		
Annex K (informative) Recommended requirements for automatic safety shutoff valves and automatic vent valves installed on gas turbines having capacities greater than 12.5 MMBtu/h (3.66 MW) and inlet pressures greater than 150 psi		

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CSA- B149.3 – 2020	CSA – B149.3 - 2015	INTERPRETATIONS AND RATIONALE
Title ***Code for the Field Approval of Fuel-burning Appliances and Equipment***	**Revised** *Code for the Field Approval of Fuel-Related Components on Appliances and Equipment*	This code is not being used to approve components on their own but rather as part of an appliance. The term appliance already covers components, control wiring, piping, etc. having these words also in the title of the code is redundant.
1.5 The requirements contained in this Code apply a) to new non-certified appliances and equipment of all inputs for which there is no approved Standard; b) when the upgrading, conversion or changes to the control system of a certified or non-certified appliance is required unless a certified conversion kit for that appliance is utilized; and c) to programmable logic controllers or microprocessor-based controls used for flame safety and fuel/air ratio control.	**Revised** The requirements contained in this Code apply (a) to new non-***certified appliance***s and ***equipment*** of all inputs for which there is no ***approved*** Standard; (b) when the upgrading of an existing ***certified*** or non-***certified appliance*** is required; and (c) to programmable logic controllers or microprocessor-based controls used for flame safety.	There are cases when new certified appliances have been purchased by consumers with the expectation of utilizing one particular fuel, then finding that a particular fuel is not available at the installation site. This change clarifies that this code may be used on new certified appliance installations, and includes changes made to control systems, and fuel type conversions.
1.9 When using digester gas, landfill gas or biogas, this code is to be used in conjunction with the code CSA B149.6.	**New**	The Biogas is already included in the Scope of the CSA B149.3, Clause 1.7, by the term ‘’manufactured gas’’. If not made clear could be confusing and lead to dangerous situations. Biogas may fall between two Regulations in some jurisdictions and the biogas valve train isn’t being evaluated on the appliance. CSA B149.6 references CSA B149.3 but CSA B149.3 did not reference CSA B149.6
2 Reference publications		

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ANSI Z21.20-2014/CAN/CSA-C22.2 No. 60730-2-5-14 *Automatic electrical controls for household and similar use — Part 2-5: Particular requirements for automatic electrical burner control systems*	**New**	Editorial
B149.6-20 *Code for digester gas, landfill gas, and biogas generation and utilization*	**New**	Reference publication was added to support the new Code Clause 1.09
CAN/CSA-ISO 9001:16 *Quality management systems - Requirements*	**New**	Referenced in Annex I (informative) Risk based program for determining requirements for an appliance in a complex and integrated facility Annex I.3 Quality management systems (QMS)
Major Industrial Accidents Council of Canada *"Hazardous Substances Risk Assessment: a Mini-Guide for Municipalities and Industry", Major Industrial Accidents Council of Canada, 1994*	**New**	Referenced in Annex I.
61511-1 (2016) *Functional safety - Safety instrumented systems for the process industry sector, Part 1: Frameworks, definitions, system, hardware and software requirements*	**New**	Referenced in Clause 19.0 Appliances In A Complex and Integrated Facility and in Annex I.
NFPA 67-2016 *Guide on Explosion Protection for Gaseous Mixtures in Pipe Systems*	**New**	Referenced in Cause 18.7.6.2 Flame Front Generator
NFPA 69-2014 *Standard on Explosion Prevention Systems*	**New**	Referenced in Cause 18.7.6.2 Flame Front Generator

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Appliance rated input — total maximum input in Btu/h of all fuels, as defined in this Code, that can be fired simultaneously in an appliance, based on their respective higher (gross) heating values (HHV). For open flares, the appliance rated input includes only the Btu value of pilot fuel and it does not include the waste product being combusted.	**Revised** **Appliance rated input** — total maximum input in Btu/h of all fuels, as defined in this Code, that can be fired simultaneously in an appliance, based on their respective Higher (Gross) Heating Values (HHV)	Clarification on interpretation of Clause 9.1.1(c) of B149.6 regarding which heat input is used in determining the flame failure response time of the flame safeguard. On open type flares, flame safeguard systems with fast response times have typically been high maintenance and subject to frequent failure.
Boiler - an appliance intended to supply hot liquid or vapour for space-heating, processing, or power purposes; does not include appliances certified as water heaters.	**New**	For consistency with CSA B149.1
Building — a structure or part thereof used or intended for supporting or sheltering persons, animals, or property and classified by its occupancy in accordance with the applicable building code of the authority having jurisdiction or, in the absence of such a code, in accordance with the *National Building Code of Canada*.	**New**	The definition was added with the inclusion of “construction requirements” from B149.1 Clause 7.2 that includes engines and turbines in buildings. To be consistent with CSA B149.1
Non aerated raw gas burner — a burner where there is no dedicated source of combustion air to the burner and the injector/nozzle is generally mounted within a process airstream providing the oxygen for combustion in appliances such as a HRSG reheat burner/duct burner, make up air burner, mine shaft burner, or inline burner. **Note:** *This should not be confused with natural draft burners.*	**New**	The definition was added in Clause 5.6.15 as there was some confusion in the industry; the “Note” was also added for clarity.
Self-piloted burner - a burner in which the pilot fuel is issued from the same ports as the main flame or merges with the main flame to form a common flame envelope with a common flame base. The supply of fuel to the pilot portion is controlled independently of the main flame.	**New**	For consistency with NFPA 86 Code covered in sections 3.3.5.14; 6.3.7.4(A) & 8.10.5. Supports new code Clauses 4.7, 4.9, A.6, Definition “Burner” 5.6.5, 5.6.6, 9.1.1

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Complex and integrated facility — a facility whose main business activity meets the definition of one of the following North American Industry Classification System (NAICS) Canada 2017 Version 1.0 codes: a) Code 32411 (petroleum refineries) b) Code 32511 (petrochemical manufacturing) c) Code 32521 (resin and synthetic rubber manufacturing)	**New**	Referenced in Clause 19 and in Annex I
Engine (reciprocating/piston engine) — a non-motive device that utilizes one or more pistons in order to convert pressure into a rotating motion. The device performs mechanical work that is used to operate other machinery and equipment.	**New**	The definition of was added with the inclusion of "construction requirements" from B149.1 Clause 7.2 that includes engines. To be consistent with the draft B149.1
Field approval - review, assessment and approval of the assembly and construction of an appliance by the AHJ or its authorized representative.	**New**	Standards Council of Canada Inspection Body ISO/IEC 17020:2012 applies to inspection bodies of type A, B or C, as defined in this International Standard, and it applies to any stage of inspection.
Flame front generator (FFG) — a manually operated or automatic ignition system whereby a combustible gas-air mixture is temporarily created and ignited inside a transmission pipe directed at the flare pilot.	**New**	Referenced in New Clause 17
Flare — a mechanical device to dispose of gaseous or vapour fuels from processes and process relief vents, by combustion in the open atmosphere.	**New**	Referenced in New Clause 17

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Flare pilot — an appliance that utilizes “gas” as defined in Clause 1.7 (either as a direct feed or as an enriching fuel) to produce a flame that is used to ignite a flare. **Locally ignited flare pilot** — a flare pilot where the gas is ignited by an ignition mechanism attached to the flare pilot and not able to be manipulated by hand by the operator during operation. **Remotely ignited flare pilot** — a flare pilot where the gas is ignited by an ignition mechanism separate from the flare pilot and able to be manipulated by hand by the operator during operation.	**New**	Referenced in New Clause 17 Flare pilot
Flare pilot automatic ignition system — a flare pilot ignition mechanism which is automated.	**New**	Referenced in New Clause 17 Flare pilot
Flare pilot manual isolation valve – a manually operated valve that is used to turn on or shut off gas to an instrument or component in a valve train on a flare pilot for the purposes of maintenance.	**New**	Referenced in New Clause 17 Flare pilot
Fuel - for the purpose of this Code, any gas, liquid, or solid that is combusted in the presence of air or oxygen so that it releases useful heat or work.	**New**	The existing term “gas” is not sufficient as the code covers various other fuels including other gases, vapours, liquids and solids.
Manufactured gas - for the purpose of this Code, any flammable gas or vapour that has been extracted, produced, or mixed by any process and is used as fuel.	**New**	The term “Manufactured Gas” is mentioned in clause 1.7 and is covered by this code, but there is no definition for what this means.

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Portable Appliance — an appliance designed to be self-contained and able to be relocated and used at multiple locations.	**New**	Referenced in new Clause 18 Additional Requirements for Portable Appliances and Equipment
Portable Equipment — equipment designed to be self-contained and able to be relocated and used at multiple locations.	**New**	Referenced in new Clause 18 Additional Requirements for Portable Appliances and Equipment
Protected inlet pressure - the maximum inlet pressure to a pilot or main pressure regulator caused by a failure of a single upstream pressure regulator.	**New**	Support of the new definition Protected inlet pressure, 4.4, 5.7, 7.4, 7.6.5 - Remove redundant text and combines requirements for overpressure protection devices for pilot and main gas trains into one clause. - Make the requirements for overpressure protection devices for pilot and main gas trains consistent to each other.
Proven low fire start – a low fire start position that is confirmed by a position–proving device or feedback signal to ensure that the command position is achieved.	**New**	***Low fire start*** is defined tern in the code; however the meaning of “proven” has been disputed. It was necessary to then define the term “Proven low fire start”.
Safe location (for venting of gas) – a location which ensures that gas being vented is safely disposed of by dispersion or destruction so it is neither trapped nor blown back into or under a building or enclosure, nor directed towards any person, walkway, staircase, ladder, vehicle traffic, operating control, source of ignition, hot surface, electrical equipment, flammable gas or liquid storage tanks or cylinders nor blocked by snow, ice, water or any other object, nor it can result in any other hazardous condition.	**New**	The definition was added for clarification on varying interpretations from industry. Table 5.2 in B149.1 did not take into consideration vertical versus horizontal separation, prevailing wind direction, snow/ice accumulation, possibility of trapping the gas or blowing it back into the building, or presence of persons (both operators or public) or vehicles near the vent termination.

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Safety Relay - a relay for safety service with special construction so as to meet high operational reliability demands. The relay is designed with an internal circuit that allows power to be removed from a load even if an internal contact welds. The relay's internal circuit is redundant and self–monitoring, using multiple, positive–guided contacts.	**New**	NFPA 86 defines the term "Safety Relay" as listed for safety service. *As an example relays meeting EN 50205, state that Relays with forcibly guided (mechanically linked) contacts, meet the intent of the 'safety relay' term."*
Turbine — a rotary device that extracts energy from a flow of combustion gas. It has an upstream compressor coupled to a downstream turbine and a combustion chamber in between. The device performs mechanical work that is used to operate other machinery and equipment. **Note:** *Gas turbine can also refer to the turbine element.*	**New**	The definition of was added with the inclusion of "construction requirements" from B149.1 Clause 7.2 that includes a turbine. To be consistent with the draft B149.1

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Voting Scheme - **1oo2 Voting scheme** – a strategy which initiates a shutdown when one or more of two redundant input devices detect that a predefined limit has been reached. **1oo2D Voting scheme** - a strategy which initiates a shutdown when one of two redundant input devices detect that a predefined limit has been reached and automatically bypasses one input device upon detection of a fault condition in that device. **2oo2 Voting scheme** - a strategy which initiates a shutdown when two of two redundant input devices detect that a predefined limit has been reached. **2oo3 Voting scheme** - a strategy which initiates a shutdown when two or more of three redundant input devices detect that a predefined limit has been reached.	**New**	Reference Clause 9.7.2.3.3. Definitions were added to provide clarity on how redundant inputs can be implemented to improve overall safety and clarify the analogue input signal requirements.
5 Pilot Supply	**Revised/Relocated from 4.1 Pilot gas valve train**	Only major editorial changes are shown all other subsequent clauses renumbered accordingly
5.1 When the pilot supply is utilizing the same fuel source as the main fuel train, the takeoff shall be: a) downstream of the appliance manual shut-off valve b) at the top or side of a horizontal fuel supply or at the side of a vertical fuel supply; and c) at a point that will supply adequate pressure for stable ignition of the pilot.	**Revised/Relocated from 4.1.1** When the ***pilot*** supply is utilizing the same fuel source as the main fuel train, the takeoff shall be: downstream of the ***appliance manual shut-off valve***	
6 Manual shut-off valves, manual isolation valves and test firing valves	**Revised/Relocated from 4.2 Manual shut-off valves, 4.6 Test firing valves, 5.5 Test firing valves.**	Only major editorial changes are shown all other subsequent clauses renumbered accordingly

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6.2 A manual shut-off valve, manual isolation valve and test firing valve shall a) be of the quarter-turn type, shall be certified to CGA 3.11, CGA 3.16, or ANSI Z21.15/CSA 9.1 or approved for use with gas, and it shall not be subjected to either a temperature or a pressure outside of its certified or approved rated range; b) when in the opened position, have the handle of the valve in parallel to the flow of gas; c) be capable of being turned to the ON and OFF positions without removal of the handle; d) have stops in the opened and closed positions; and e) have an attached handle or loose-fitting key, or extended handle wrench.	**Revised/Relocated from 4.2.2,4.2.3 and 5.1.2, 4.6.3 and 5.5.2, 4.6.4 and 5.5.3, 4.6.5 and 5.5.4** 4.2.2 A ***pilot manual shut-off valve*** shall be of the quarter-turn, plug, ball, or eccentric type and it shall not be subjected to either a temperature or a pressure outside of its ***certified*** rated or **approved** rated range. 4.2.3 and 5.1.2 A ***pilot manual shut-off valve*** shall be ***certified*** to CGA 3.11, CGA 3.16, ANSI Z21.15/CSA 9.1 or ***approved*** for use with gas, and shall not be subject to either a temperature or a pressure outside of its ***certified*** or ***approved*** rated range. 4.6.3 and 5.5.2 When a test firing valve is in the open position, the handle of the valve shall be parallel to the flow of gas, and the valve shall be capable of being turned to the ON and OFF positions without removal of the handle. 4.6.4 and 5.5.3 The ***test firing valve*** shall be a quarter turn ***manual shut-off valve*** that (a) is rated for the temperature, fuel type, and pressure to which it is subject; (b) has stops in the OPEN and CLOSED positions; and (c) has an attached handle or loose-fitting key, or extended handle wrench. 4.6.5 and 5.5.4 The ***test firing valve*** shall be ***certified*** to CGA 3.11, CGA 3.16, or ANSI Z21.15/CSA 9.1, or ***approved*** for use with gas, and shall not be subjected to either a temperature or a pressure outside of its ***certified*** or ***approved*** rated range.	A non-eccentric manual valve that complies with CGA 3.16, has the same level of safety as a plug, ball or eccentric valves certified to the same standard. Editorial changes to combine 9 clauses into 1.

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7.2.2 A pilot shall be designed, installed, and adjusted to provide safe and reliable ignition of the main burner and so that there will be no injurious flame impingement on heating surfaces that can cause incomplete combustion or damage to these surfaces.	**Revised/Relocated from 4.7.2 and 4.7.4** 4.7.2 A pilot shall be designed and installed to ensure safe and reliable ***ignition*** of the main ***burner***. 4.7.4 A ***pilot burner*** shall be so installed and adjusted that there will be no injurious flame impingement on heating surfaces that can cause incomplete combustion or damage to these surfaces.	
7.2.7 A pilot burner shall maintain stability of the designed flame shape, with neither flashback nor blow-off, over the entire burner firing range. In addition, a pilot turndown test, or similar method, shall be conducted to prove that the pilot is capable of reliably lighting the main burner in credible firing conditions.	**New**	A pilot should have to meet the same requirement as a main flame and that a pilot turndown test is a critical part of assessing the pilot burner`s ability to consistently light the main flame smoothly.
7.3 Self-Piloted Burner The pilot portion of a self-piloted burner shall meet the requirements contained in Clauses 4 to Clause 7 and 10 and all applicable clauses where the term pilot is used.	**New**	There is currently no support in the code for self-piloted burner technology. As a result of this gap a variance is required from the AHJ. This is a valid configuration and is covered is sections 3.3.5.14; 6.3.7.4(A) & 8.10.5 of NFPA 86 code.
8 Main safety shut-off valves, Input flow control systems and Main Burners	**New**	Editorial
8.3 Main burner	**Relocated from 5.6 Main burner**	Only major editorial changes are shown all other subsequent clauses renumbered accordingly
8.3.6 When a combustion airflow controlling device on a burner is operated automatically, it shall a) comply with the requirements of Clause 8.3.5 ; and b) be designed to mitigate hazardous conditions upon failure of it's operating mechanism.	**Revised/Relocated from 5.6.6**	Some applications could result in a hazard if the airflow goes to maximum upon failure of the operating mechanism. The change keeps the original intent of the clause calling attention that failures in the mechanism could lead to an unsafe state.

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9 Additional requirements for liquid propane valve trains	**Relocated from 6**	Only major editorial changes are shown all other subsequent clauses renumbered accordingly
9.1 All piping shall be Schedule 80 or heavier, flanges shall be minimum Class 150 and all other fittings shall be minimum Class 300.	**Revised** All piping shall be Schedule 80 or heavier.	The new wording clarifies that class 300 lb. fittings are the minimum when installed on schedule 80 piping systems.
9.5 Where dictated by the valve train design, the liquid propane regulator may be located immediately upstream of the test firing valve or may be omitted when the supply pressure to the burner valve train is required to be greater than tank pressure and is being controlled by a pump system equipped with a differential bypass valve and backpressure regulator suitable for use with LPG. Setpoints of the differential bypass valve and backpressure regulator shall be in accordance with the burner manufacturer's installation instructions.	**Revised** Where dictated by the ***valve train*** design, the liquid propane regulator may be located immediately upstream of the ***test firing valve.***	The pressure control requirements for liquid burners such as grain dryers and asphalt plants can be very different from one another. Some manufactures of burners installed on asphalt plants, do not want diaphragm type or lock up type regulators used on their fuel trains. The installations require the use of LPG pumps at the tank location and recommend the use of a backpressure regulator used in conjunction with a differential bypass regulator both installed at the LPG pump location. The design of the burners is such that they need to maintain a set pressure over tank pressure. For example Gencor requires 40 psi over tank pressure be maintained when firing liquefied petroleum gas, failure to do this causes either vaporization of the LPG within the piping system or flame instability and lift off. There are also special considerations due to the inability to utilize vent valves or valve proving which is to provide proof of closure on both valves on all burners in excess of 200,000 Btuh. A drawing of a Liquid propane valve train has been added in Annex B (informative) Figure B.9 Cont.

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9.7 A single burner appliance that has a rated input in excess of 400 000 Btu/h (120 kW) shall be equipped with at least two safety shut-off valves in series. Each safety shut-off valve shall be equipped with a proof of closure switch that is integrated with the start-up circuit of the combustion safety control.	**New**	Cont.
9.8 A multiple burner appliance that uses a common burner flame safeguard shall be equipped with at least two safety shut-off valves in series to each burner. Where a main header safety shut-off valve is installed, it can be considered one of the two safety shut-off valves in series to each burner.	**New**	Cont.
9.9 The requirements of Clause 4 do not apply to liquid propane valve trains when the supply pressure to the burner valve train is required to be greater than tank pressure and is being controlled by a pump system equipped with a differential bypass valve and backpressure regulator suitable for use with LPG.	**New**	Cont.
10.4 Pressure ratings and overpressure protection devices	**Revised/Relocated from 7.4 Pressure ratings** A ***valve train component*** shall have a pressure rating not less than the protected inlet pressure to the ***component*** .	Supports the new definition Protected inlet pressure 4.4, 5.7, 7.4, 7.6.5 - Removes redundant text and combines requirements for overpressure protection devices for pilot and main gas trains into one clause. - Makes the requirements for overpressure protection devices for pilot and main gas trains consistent to each other.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
10.4.4 Overpressure protection shall be provided by any one of the following: a) monitoring regulator; b) overpressure relief device; c) series regulator; d) overpressure shut-off device or (OPCO) device; or e) a high gas pressure safety device with a manual reset feature that will interrupt power to the safety shut-off valve and both dedicated only to overpressure protection function.	**5.7.2 Relocated / Revised** Overpressure protection shall be provided by any one of the following: (a) ***monitoring regulator***; (b) ***pressure relief valve***; (c) ***series regulator***; or (d) ***overpressure cut-off.***	Overpressure protection is not required to be provided by a single device. (b), "pressure relief valve" was replaced by the defined term "overpressure relief device"; (d), "overpressure cutoff device" was replaced by the defined term "overpressure shut-off device or overpressure cut-off (OPCO) device". It is acceptable to use a PSH (either upstream or downstream of the upstream SSV) and the upstream SSV with proper pressure certification to properly protect all the downstream devices.
10.9 Supplementary requirements for controls and valves subjected to low ambient temperatures	**Relocated from 7.9**	Only major editorial changes are shown all other subsequent clauses renumbered accordingly
10.9.3 A heated compartment shall be equipped with a low limit temperature control that will operate and be interlocked with the flame safeguard to positively prevent operation of the fuel burners if the temperature within the heated compartment for any reason drops 18°F (10 °C) below the value specified in Clause 10.9.2.	**New/Relocated from 7.9.3**	To be consistent with the text found in CSA Standard C22.2 No. 3-M1988 *Electrical Features of Fuel-Burning Equipment.* The following clauses were added to indicate that electrically-heated compartments shall be equipped with a low limit temperature control.
10.9.4 The low limit temperature control required by Clause 10.9.3 shall be of the automatic recycling type.	**New/Relocated from 7.9.4**	To be consistent with the text found in CSA Standard C22.2 No. 3-M1988 *Electrical Features of Fuel-Burning Equipment*. The following clauses were added to indicate that electrically-heated compartments shall be equipped with a low limit temperature control.

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10.11 Multi-fuel burners When a dual or multi fuel burner has fuel trains that connect for the purpose of using the same exit holes on the burner for combustion, unless the design is such that it prevents the alternate fuel/s from back feeding through the alternate fuel train/s, suitable means shall be provided to prevent back feeding. Manual shut-off valve or safety shut-off valves, with end switches wired into the limit circuit to allow operation of the alternate fuel when closed, or back pressure check valves may be used as an acceptable solution. These valves, when used shall be installed as close as practicable to the point of interconnection. **Note:** *The test firing valve required by Clause 6.4 may be used when equipped with end switches to prove closure.*	**New**	Currently there are no provisions for interconnection of fuel trains. There are installations that utilize, dependent on the fuel selector switch, either propane, natural gas or bio-gas. On FARC systems of the metering type the fuels can run concurrently and mix prior to leaving the exit holes on the burner.
12.1 Combustion safety control systems	**Relocated from 9.1**	Only major editorial changes are shown all other subsequent clauses renumbered accordingly
12.1.5 When the combustion safety control system is not suitably rated for the electrical load of the safety shut-off valves, an intermediate safety relay circuit shall be used.	**New**	The issue of electrical loading for valves is typical of larger diameter valving systems.
12.4 Temperature and pressure safety limit controls	**Relocated from 9.4**	Only major editorial changes are shown all other subsequent clauses renumbered accordingly

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12.4.1 An appliance that heats a liquid or vapor shall be equipped with all of the following fuel supply shut off safety devices as required for safe operation of the appliance. a) low liquid level in an appliance requiring continuous immersion of heat transfer tubes; b) low liquid or vapor flow in an appliance requiring a minimum flow; c) high fluid temperature; **Note:** *Where portions of the appliance are sufficiently independent, multiple temperature sensors might be required;* d) high fluid pressure for a vaporizing appliance that is not a boiler; e) high steam pressure for a steam boiler with a maximum rated input of less than 12.5 MMBtu/h; f) high steam pressure for a steam boiler with a maximum rated input greater than or equal to 12.5 MMBtu/h in unattended operation; and g) low water in a water boiler located above the hot-water circulating system. The safety devices shall include a manual-reset feature or shall require operator attention before resuming operation.	**Revised/Relocated from 9.4.1** An ***appliance*** that heats a liquid or vapor shall be equipped with ***approved*** safety devices provided with a manual-reset feature or shall require operator attention before resuming operation, the sole function of which shall be to shut off the fuel supply in the event of (a) low liquid level in an ***appliance*** with a minimum liquid level that requires continuous immersion in a liquid for safe operation; (b) low liquid or vapor flow in an ***appliance*** that requires flow for safe operation; (c) high fluid temperature for an ***appliance*** where the temperature can exceed a safe operating limit. Where portions of the ***appliance*** are sufficiently independent, multiple temperature sensors might be required; (d) high pressure for vaporizing ***appliances*** which are pressure controlled and pressure is a function of temperature; or (e) low water in a water boiler located above the hot-water circulating system.	**CSA Errata / Update** The original intent was if you can create a hazardous condition by excessive temperature, pressure, or lack of level or flow, then the appliance safety controls must result in a safe appliance condition. There are two different things being described in the clause. First the system must incorporate each of the safety devices where applicable. Second if there is a trip from any of the safety devices then the appliance burners are shut down, meaning there are multiple safety devices but only one trip. The original sentence was correct for the actual trip as you only trip on one item. However, you could have a low level one day and a high temperature the next day. These are different trip conditions but they still result in the same thing.
12.5 Gas pressure safety limit control	**Relocated from 9.5**	Only major editorial changes are shown all other subsequent clauses renumbered accordingly
12.5.5 The low gas pressure safety device and high gas pressure safety device shall be of the manual reset type or operator attention shall be required before resuming operation.	**New**	CSA 3.1 and 4.9 require these safety devices to cause a safe shutdown, all new boilers are shipped with this manual reset function.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
12.7.2 Programmable controllers	**<u>Relocated from 9.7.2</u>**	Major editorial changes are shown all other subsequent clauses renumbered accordingly
12.7.2.3.1 Critical input signals are process parameters that activate a BMS master fuel trip and shall be configured in the fail-safe mode. All critical input signal devices shall be hard-wired directly to the BMS. Bypass switches for non-redundant critical field inputs shall not be permitted. Communications between the BMS and other micro-processor –based systems shall be permitted.	**<u>Revised/Relocated from 9.7.2.3.1</u>** Critical input signals are process parameters that activate a BMS master fuel trip and shall be configured in the fail-safe mode. Input channels for all critical signals shall incorporate a continuous self-test feature that satisfies the requirements of Clause 9.7.2.3.2 or 9.7.2.3.3, or they shall be hard-wired to the master fuel trip relay. Bypass switches for critical field inputs shall not be permitted.	Clause 12.7.2.3.1 is generic for all critical inputs and Clause 12.7.2.3.2 has been updated to have all of the requirements for discrete inputs. The old Clause 9.7.2.3.3 was being used specifically for analog signals, but it included general requirements, so this usage has been clarified and the general requirements were moved to Clause12.7.2.3.1. The first sentence of Clause 9.7.2.3.3 was not well understood because it was referencing communication in general, but this section should be specific to communication from a safety critical device, which must be hardwired directly to the BMS. Since this section of the code is only related to critical safety devices, it has been interpreted to indicate a trip signal can come from the DCS since it is a microprocessor based system. This has resulted in analogue transmitters associated with the process side of the appliance (eg. high temperature, low flow, low level, etc.) being hardwired to the DCS where the trip setpoint is programmed into the DCS which then sends a hardwired discrete signal back to the BMS-PLC. This one DCS trip signal may be a common trip that includes multiple logic blocks with various trips (eg. related appliances shutdown, safety flare shutdown, plant fire, gas leak detected, etc). This configuration indicates the DCS or basic process control system (BPCS) is now part of the safety instrumented system (SIS) because the trip point is programmed in the DCS/BPCS. The DCS/BPCS should not be permitted to be part of a critical SIF for the appliance. Instead, all transmitters dedicated to the appliance and used as part of a safety instrumented function (SIF) should be hardwired to the BMS-PLC or SIS and the trip setpoint should be programmed into the BMS-PLC or SIS, which means the DCS is not part of the SIS.

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12.7.2.3.2 When discrete field devices are used for critical input signals, the following shall apply a) input channels for all critical signals shall incorporate a continuous self-test feature. The interrogation voltage to all critical field devices shall be periodically removed. Any channel recognized as faulty shall be alarmed and a BMS trip shall be activated; or b) the critical field devices shall be hard-wired to the master fuel trip relay.	**Revised/Relocated from 9.7.2.3.2** The interrogation voltage to all critical field devices shall be periodically removed. Any channel recognized as faulty shall be alarmed and a BMS trip shall be activated.	Cont.

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12.7.2.3.3 Analog signals from digital field devices shall be permitted for critical input signals. When analog field devices are used for critical input signals, the following shall apply: a) a faulted analog signal used as the primary process variable measurement shall initiate a master fuel trip or default to an approved safe condition; b) a faulted analog signal used as a supporting signal to compensate and improve the accuracy of the primary measurement device shall initiate an alarm; and c) digital signal variables from field devices, available using digital communication protocols (eg. HART, Modbus), shall not be permitted as the primary signal to initiate a master fuel trip. These signals are permitted as a secondary trip function (eg. to identify a faulted transmitter) or as an alarm function. ***Notes:*** 1) *A HART or Modbus are examples are digital communication protocols.* 2) *An example of a secondary trip function is to identify a faulted transmitter.*	**Revised/Relocated from 9.7.2.3.3** One of two or two of three voting schemes may be implemented. Inputs via communications between the BMS and other microprocessor-based systems shall be permitted. Signals that initiate a master fuel trip shall be hard-wired. When analogue input signals associated directly with the BMS are used, the following shall apply: (a) the analogue transmitter shall be dedicated to the BMS; and (b) out-of-range signals shall default to the safe condition.	Cont.

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12.7.2.3.4 Redundant input devices may be used to initiate a master fuel trip. When two redundant input devices are utilized, a 1oo2 voting scheme or a 1oo2D voting scheme shall be implemented. When three redundant input devices are utilized a 2oo3 voting scheme shall be implemented. A 2oo2 voting scheme shall only be permitted in the case of two redundant flame scanners that are SIL3 certified to IEC61508. When redundant input devices are utilized, one of the redundant input devices may be temporarily bypassed for maintenance purposes.	**New**	It is permissible to bypass a redundant input device but it is not permissible to bypass a tripping function. NFPA85 allows interlocked devices shall be permitted to be temporarily removed from service for maintenance or testing in accordance with the following: 1) Removal of the interlock shall be authorization by a competent person and documented in accordance with operating procedures, 2) Alternate means shall be substituted to supervise this interlock function in accordance with operating procedures. The key concepts above are “temporary” and “substitution”. The proposed modification does both. A redundant 1oo2 scheme when one input device is bypassed becomes a 1oo1 approach. A 2oo3 scheme when one input device is bypassed becomes a 1oo2 approach. TUV calls this input device reduction and subsequent modified voting scheme control system “degradation”. Also see new definition “voting scheme”

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14 Rating plate An appliance shall have a clearly legible permanent rating plate that shall include the following information: a) manufacturer's or vendor's name; b) appliance type and identification number; c) electrical specifications; d) type of fuel(s); e) maximum input rating in Btu/h (kW) and design altitude in ft (m); f) minimum inlet pressure and maximum protected inlet pressure at the point of connection; g) maximum and minimum burner manifold fuel pressure; and h) a statement identifying if it is portable	**Revised/Relocated from 11** An ***appliance*** shall have a clearly legible permanent rating plate that shall include the following information: (a) manufacturer's or vendor's name; (b) ***appliance*** type and identification number; (c) electrical specifications; (d) type of fuel(s); (e) maximum input rating in Btu/h (kW) and design altitude in ft (m); (f) inlet pressure at the point of connection; and (g) maximum and minimum ***burner manifold*** fuel pressure.	Regarding "the protected inlet supply pressure" (in the Clauses 14.5 "protected inlet supply pressure" would represent maximum safe inlet pressure and would be consistent with current accepted definition of protected inlet pressure and Clause 10.4 in the B149.3 running draft. Minimum inlet pressure is also important to be added to the "Marking/Rating plate" information required in the Clause. This is to support the new section for portable appliance and equipment, Section 14.
16 Additional requirements for process ovens, process furnaces, and atmosphere generators	**Relocated from 13**	

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
16.1 Scope	**New**	The phrase “process furnaces” has a meaning that is different in different industries. Clause 16 is intended to apply appliances such as “furnaces” defined in NFPA 86 (see below). 3.3.27 Furnace. 3.3.27.1 Atmosphere Furnace. A furnace built to allow heat processing of materials in a special processing atmosphere. 3.3.27.2 Batch Furnace. A furnace into which the work charge is introduced all at once. 3.3.27.3* Class A Furnace. An oven or furnace that has heat utilization equipment wherein there is a potential explosion or fire hazard that could be occasioned by the presence of flammable volatiles or combustible materials processed or heated in the furnace. 3.3.27.4* Class B Furnace. An oven or furnace that has heat utilization equipment wherein there are no flammable volatiles or combustible materials being heated. 3.3.27.5* Class C Furnace. An oven or furnace that has a potential hazard due to a flammable or other special atmosphere being used for treatment of material in process. 3.3.27.6* Class D Furnace. An oven or furnace that is a pressure vessel that operates under vacuum for all or part of the process cycle. 3.3.27.7 Continuous Furnace. A furnace into which the work charge is more or less continuously introduced. 3.3.27.8 Molten Salt Bath Furnace. A furnace that employs salts heated to a molten state, excluding aqueous alkaline baths, hot brine, or other systems utilizing salts in solution. 3.3.27.9 Plasma Arc Furnace. A furnace that employs the passage of an electric current between a pair of electrodes or between electrodes and the work and that ionizes a gas (such as argon) and transfers energy in the form of heat. Cont.

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16.1.1 This Clause is intended for appliances used in commercial and industrial processing application (e.g., heating treating of metal in a hydrogen atmosphere).	**New**	Cont. 3.3.48 Oven. See 3.3.27.1 through 3.3.27.9, Furnace definitions. A.3.3.27.3 Class A Furnace. Flammable volatiles or combustible materials can include, but are not limited to, any of the following: (1) Paints, powders, inks, and adhesives from finishing processes, such as dipped, coated, sprayed, and impregnated materials (2) Substrate material (3) Wood, paper, and plastic pallets, spacers, or packaging materials (4) Polymerization or other molecular rearrangements In addition, potentially flammable materials, such as quench oil, waterborne finishes, cooling oil, or cooking oils, that present a hazard should be ventilated according to ClassA standards. A.3.3.27.4 Class B Furnace. It is important to note that the loads processed in Class B furnaces typically do not contain any flammable volatiles or combustible materials. However, when small amounts of flammable volatiles or combustible materials are present, it can be appropriate not to add safety ventilation, as would be required for a Class A furnace, when doing so would be detrimental to the process and would not increase the level of safety. (See A.3.3.25.3.) A.3.3.27.5 Class C Furnace. This type of furnace uses any type of heating system and includes a special atmosphere supply system(s). Also included in the Class C classification are integral quench furnaces and molten salt bath furnaces. A.3.3.27.6 Class D Furnace. During inert gas quenching, Class D furnaces operate at pressures from below atmospheric to over a gauge pressure of 100 psi (690 kPa).

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16.1.2 Clause 16 does not apply to appliances in a facility whose main business activity meets the definition of one of the following North American Industry Classification System (NAICS) Canada 2017 Version 1.0 codes: a) Code 21111 (oil and gas extraction) b) Code 21114 (oil sands extraction) c) Code 32411 (petroleum refineries) d) Code 32511 (petrochemical manufacturing) e) Code 32519 (other basic organic chemical manufacturing) f) Code 32521 (resin and synthetic rubber manufacturing) g) Code 32531 (fertilizer manufacturing) h) Code 32532 (pesticide and other agricultural chemical manufacturing) i) Code 32599 (all other chemical product manufacturing) **Note:** *Due to the nature and process of petroleum refining, some of the requirements in Clause 16 can create hazards for the refining process. Designers typically identify any operating requirements that are needed in addition to Clauses 1 – 15 of this Code.*	**New**	Cont.
17 Generators, compressors/pressure boosters, engines and turbines	**New/Relocated from B149.1 Clause 7.2** **Generators, compressors/pressure boosters, engines and turbines**	Only the clauses that had major revisions are shown subsequent clauses have been renumbered accordingly.
17.1 General requirements	**New/Relocated from B149.1 Clause 7.2.1** **General requirements**	

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17.1.1 The installation of appliances and associated equipment covered by Clause 17 shall comply with Clause 7.2 of the CSA B149.1, which covers generators, compressors/pressure boosters, engines, and turbines.	**New/Revised/Relocated from B149.1 Clause 7.2.1.1** The installation of appliances and associated equipment covered by Clause 7.2 shall comply with this Code, applicable Standards, manufacturer's instructions, and local requirements, including fire regulations, building codes, and zoning requirements	There are higher risks associated with equipment having greater capacities. Gas leaking into a gas engine or turbine can result in an explosion in the engine/turbine or in the exhaust, both being a hazard that needs to be mitigated by increasing the safety on the gas train.
17.2 Compressors/pressure boosters	**New/Relocated from B149.1 Clause 7.2.2**	Cont.
17.2.1 A compressor/pressure booster or similar equipment capable of reducing pressure in the service piping to a point lower than the required service pressure shall be provided with a low-pressure cut-off device of the manual-reset type.	**New/Relocated from B149.1 Clause 7.2.2.3**	Cont.
17.2.2 A compressor shall be isolated from vibration at the inlet or outlet by a gas hose certified to the CAN/CSA-8.1, CAN/CSA-8.3, ULC/ORD C536 or CGA CR96.	**New/Revised/Relocated from B149.1 Clause 7.2.2.6** A compressor shall be isolated from vibration at the inlet or outlet by a flexible metallic ***hose*** certified in compliance with ULC C536	Cont.
17.2.3 A pressure booster capable of creating an outlet pressure higher than the normal operating pressure shall be equipped with a mechanical bypass around the booster and a high gas pressure safety device installed in the booster outlet piping set to prevent the system pressure from exceeding the normal operating pressure by 20%.	**New/Revised/Relocated from B149.1 Clause 7.2.2.9** A pressure booster capable of creating an outlet pressure higher than the normal operating pressure shall be equipped with a mechanical bypass around the booster and a high-gas–pressure switch installed in the booster outlet piping set to prevent the system pressure from exceeding the normal operating pressure by 20%.	Cont.
17.3 Engines and turbines	**New/Revised/Relocated from B149.1 Clause 7.2.4**	

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
17.3.1 If the generator is used as emergency electrical supply system defined by CSA C282, the gas train safety interlocks, if installed, shall be permitted to be wired and operated in accordance with Table 1 of CSA C282.	**New**	Clarifies the code of use for the wiring and operation.
17.3.2 A turbine not falling under Clause 17.3.5 or engine shall be equipped with a) safety shut-off valve or valves as required in Clause 17.3.3 that are certified in accordance with the requirements of ANSI Z21.21/CSA 6.5. It shall be controlled by a vacuum switch, oil pressure switch, or an equivalent device to prevent the flow of gas to the fuel system on the engine or turbine when it is not running; b) an automatic speed governor; c) a vacuum switch or low-oil-pressure switch; d) a zero-governor-type regulator or gas control valve; and e) a gas hose certified to the CAN/CSA-8.1, CAN/CSA-8.3, ULC/ORD C536, or CGA CR96, not exceeding 6 ft (2 m) in length, where the gas hose is installed downstream of the safety shut-off valve or valves required under Item a). The valve train upstream of the gas hose shall be mounted, anchored, and supported in such a manner as to minimize damage to the valve train from the engine or turbine vibration.	**New**	The existing B149.1 language that will be moved into the B149.3 is fitted for smaller gen sets for residential and light commercial applications; it did not take into account adequately for increased risks that larger gen sets and turbine engines. There needed to be increase of safety incorporated into the gas train as the Btu/h's increase, as is currently with burners. The Proposed follows B149.3 and NFPA 37. Removed the requirement for an additional safety shutoff valve on propane applications.

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17.3.3 A turbine not falling under Clause 17.3.5 or engine shall comply with the following: Where the input to an engine or turbine is: a) up and including 2.5 MMBtu/h (732 kW), one safety shut-off valve marked C/I or two safety shut-off valves or one safety shut-off valves. However, if propane-fueled, a minimum of two safety shut-off valves shall be provided. b) over 2.5 MMBtu/h (732 kW) and up to and including 5 MMBtu/h (1464 kW) at least two safety shut-off valves shall be provided, each marked C/I, and shall be piped in series and wired in parallel; c) over 5 MMbtu/h (1464 kW) and up to and including 12.5 MMBtu/h (3660 kW, two safety shut-off valves in series, each marked C/I. At least one safety shut-off valve shall be equipped with a proof of closure switch that is integrated with the start-up circuit; and d) over 12.5 MMbtu/h (3660 kW), at least two safety shut-off valves in series, each marked C/I. Each safety shut-off valve shall be equipped with a proof of closure switch that is integrated with the start-up circuit. The two safety shut-off valves shall be supervised by an approved valve proving system (VPS), which is integrated into the start-up circuit and prevent safety shut-off valves from opening when a leak is detected, or be equipped with an automatic vent valve installed in a vent line that is connected into the valve train immediately downstream of the first automatic safety shut-off valve.	**New**	There are higher risks associated with equipment having greater capacities. Gas leaking into a gas engine or turbine can result in an explosion in the engine/turbine or in the exhaust, both being a hazard that needs to be mitigated by increasing the safety on the gas train.

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17.3.4 Where the input to an engine or turbine is in excess of 2.5 MMBtu/h (732 kW), a high gas pressure safety device and a low gas pressure safety device shall be installed and set to detect incorrect outlet pressure ranges of the pressure regulator.	**New**	There are higher risks associated with equipment having greater capacities. Gas pressure should be monitored for larger engines and turbine because too high or too low of pressure can lead to improper combustion and unburnt fuel into the exhaust.
17.3.5 A turbine having capacities greater than 12.5 MMBtu/h (3.66 MW) and inlet pressures greater than 150 psi shall be equipped with a) Two safety shut-off valves in series, each with proof of closure, and automatic vent valve installed downstream of the first safety shut-off valves. Each safety shutoff valve and the automatic vent valve shall be approved for use in the application; **Note:** *See Annex K for recommended requirements automatic valves to be approved for use.* b) a control valve and a turbine controller to maintain proper turbine speed, and c) a gas hose, having a length recommended by the hose manufacturer for the application, shall be installed between the turbine and the control valve or between the turbine and the externally installed safety shutoff valve.	**New**	There are higher risks associated with equipment having greater capacities. Gas leaking into a gas engine or turbine can result in an explosion in the engine/turbine or in the exhaust, both being a hazard that needs to be mitigated by increasing the safety on the gas train.
17.3.6 Where a engine or turbine is of an automatic-start type, it shall be equipped with overcrank protection in addition to the requirements of Clauses 17.3.2 through 17.3.4.	**New/Revised/Relocated from B149.1 Clause 7.2.4.5** Where a stationary ***engine*** or ***turbine*** is of an automatic-start type, it shall be equipped with overcrank protection in addition to the requirements of Clauses 7.2.4.2 and 7.2.4.3.	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
17.3.7 Where the inlet pressure is in excess of 0.5 psig (3.5 kPa), a pressure regulator of the lock-up type shall be provided to the entrance to the valve train.	**New/Revised/Relocated from B149.1 Clause 7.2.4.6** Where the gas supply inlet pressure is in excess of 0.5 psig (3.5 kPa), a ***pressure regulator*** of the lock-up type shall be provided to the entrance to the ***valve train***.	Cont.
17.3.8 The valve train shall meet the over-pressure protection requirements of Clause 10.4	**New**	There are higher risks associated with equipment having greater capacities. Gas leaking into a gas engine or turbine can result in an explosion in the engine/turbine or in the exhaust, both being a hazard that needs to be mitigated by increasing the safety on the gas train.
17.3.9 A regulator or relief valve shall be vented to a safe location outdoors and shall meet the requirements for venting or pressure control devices per Clause 5.5 of the CSA B149.1	**New**	Cont.
17.4 Additional requirements for engines and turbines in buildings	**New/Revised/Relocated from B149.1 Clause 7.2.5**	
17.4.1 An engine or turbine installation in a building shall be in compliance with Clause 7.2.5 of the B149.1	**New**	Cont.
17.4.2 The equipment for indoor installation or in an enclosure shall be equipped with a gas detector that a) is installed in accordance with the detector manufacturer's instructions for the type of gas; b) is set to activate at gas detection levels at and above one-fifth of the lower limit of flammability; c) upon activation, produces an audible and visual alarm; d) is interlocked with the mechanical ventilation system; and e) is interlocked to shut off the equipment.	**New/Revised/Relocated from B149.1 Clause 7.5.2.8** Propane-fuelled stationary **engines** or **turbines** shall be equipped with two solenoid **valves**, installed in series and wired in parallel, installed immediately upstream of the **gas hose** required in Clause 7.2.4.2. They shall be controlled by a vacuum switch, oil pressure switch, or an equivalent device to prevent the flow of gas to the fuel system of the stationary **engine** or **turbine** when it is not running.	There are higher risks associated with equipment having greater capacities. Gas leaking into a gas engine or turbine can result in an explosion in the engine/turbine or in the exhaust, both being a hazard that needs to be mitigated by increasing the safety on the gas train.

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17.5 Each engine or turbine shall be provided with a clearly legible, permanent rating plate indicating a) manufacturer's or vendor's name; b) type of fuel(s); c) electrical rating; d) maximum input rating in Btu/h (kW); and e) minimum and protected inlet pressure at the point of connection.	**New/Revised/Relocated from B149.1 Clause 7.2.4.10** Each *engine* or *turbine* shall be provided with a clearly legible, permanent rating plate indicating: (a) the manufacturer's or vendor's name; (b) the fuel supplied; (c) the electrical rating; (d) the maximum input rating; and (e) the inlet pressure at the point of connection to the supply piping.	Editorial changes for clarity.
18 Flare pilot	**New**	
18.1 General	**New**	
18.1.1 When a provincial or territorial law, act or regulation requires a single flare pilot or multiple flare pilots, and/or flare pilot instrumentation, on an effluent discharge, this Code defines how the components of a flare pilot are installed. **Note:** *"Safety flare" and "process flare" were defined terms in the previous version of the Code, used to describe combustion devices used in industrial plants, including petroleum refineries, petrochemical plants, natural gas processing plants in the downstream processing industry, as well as upstream oil and gas production facilities including oil wells, gas wells, offshore oil and gas rigs, and landfills. For clarity the distinction between "process flares" and "safety flares" has been removed from the Code and instead extra requirements for what was previously called a "safety flare" have been specified in individual clauses using the phrase "when a provincial or territorial law, act or regulation requires…".*	**New**	New clause/section added for flare pilots, making clearer to the user which clause(s) in this Code apply to flare pilots Prescriptive clauses created minimize need for interpretation.

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18.1.2 A flare pilot shall comply with requirements in clauses 1, 2, 3, 13, 14 and 18. Components of flares not related to flare pilots shall have no additional requirements herein. **Note:** *This Code does not specify when a flare pilot is required. Standards, statutes, rules, or regulations; including but not limited to environmental and energy standards, statues, rules or regulations, define when a flare pilot is required. For example, B149.6, AER Directive 60, Saskatchewan Directive S20.* *Requirements for vent stacks and flares are specified in environmental or energy statues, rules and regulations.*	**New**	Cont.
18.1.3 A remotely ignited flare pilot that is of the flame front generator type shall not have a fuel and air mixture present when the flame front generator is not in use.	**New**	Cont.
18.1.4 When a provincial or territorial law, act, or regulation requires a single flare pilot or multiple flare pilots to withstand severe weather conditions, each new flare pilot shall be capable of lighting and sustaining stable combustion of the flare pilot gas throughout the flare pilot's full operating range, including wind speeds up to 160 km/h under dry conditions and 140 km/h when combined with at least 50 mm/h of rainfall. This performance shall be verified by testing in accordance with documented test protocol and documented results. Existing flare pilots shall be exempted from this requirement if they have proven history of reliable operation for the specific installation for a minimum 5 years with no reported non-compliances with regards to the provincial or territorial law, act, or regulation. **Note:** *API 537, Clause A.6 provides a typical test protocol.*	**New**	Cont.

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18.1.5 When a flare pilot a) is supplied by process gas; b) requires injection of an enriching fuel into the process gases being disposed of in the flare, for proper operation of the flare pilot; and c) the enriching fuel is gas as defined in Clause 1.7; Clauses 18.1 through 18.9 shall apply to the enriching gas piping and valve train components downstream of the appliance manual shut-off valve defined in Clause 1.1, and upstream of the manual shut-off valve defined in Clause 18.2.14 which isolates the enriching fuel piping from the flare process piping.	**New**	Cont.
18.1.6 When a flare pilot fuel is liquid propane, the valve train shall meet the requirements of Clauses 9.1, 9.2, 9.3, 9.4, 9.5 and 9.9.	**New**	Cont.
18.2 Valves for flare pilots	**New**	Cont.
18.2.1 Manual shut-off valves		
18.2.1.1 The body of manual shut-off valve(s) in the valve train of flare pilots and flame front generators shall not be constructed of material with a melting point less than 1100 °C. **Note:** *Materials with melting point less than 1100 ° C include aluminum, brass, bronze. copper, lead & plastic.*	**New**	Cont.

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18.2.1.2 The manual shut-off valve in the valve train of a flare pilot shall be quarter-turn type, certified to CSA 3.11 or CSA 3.16, or approved for use with gas. These valves shall not be subjected to either a temperature, a pressure or a fluid-material compatibility outside of their certified or approved rated range.	**New**	Cont.
18.2.1.3 When a flame front generator installed at ground level is used to ignite a flare pilot, a normally closed manual shut-off valve in accordance with Clause 18.2.1.2 shall be installed.	**New**	Cont.
18.2.1.4 The manual shut-off valve subject to Clause 18.2.1.2 shall be installed at a location: a) where the operator will not be subjected to a radiation intensity from the flare of more than 500 Btu/hr/ft^2 (1.6 kW/m^2); and b) at a minimum distance of 20 ft (6.1 m) from the base of the flare.	**New**	Cont.
18.2.1.5 When a naturally aspirated flame front generator installed at ground level is located in a hazardous location, as defined by *Canadian Electrical Code, Part I*, a manual shut-off valve in accordance with Clause 18.2.5.3 shall be installed downstream from the gas-air mixing element, upstream of the igniter, and equipped with an electric or pneumatic limit switch connected within the flame front generator igniter circuit; and the igniter shall be interlocked to ensure that it can only be energized when the manual valve in accordance with Clause 18.2.5.3 is detected closed.	**New**	Cont.

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18.2.1.6 When an enriching fuel is injected into process gases in accordance with Clause 18.1.5, a manual shut-off valve in accordance with Clause 18.2.1.2 shall be installed downstream of all enriching fuel valve train components to isolate the enriching fuel from the process gas piping and that manual shut-off valve shall act as the pipe specification break between the enriching fuel and the flare process piping.	**New**	Cont.
18.2.2 Flare pilot manual isolation valves	**New**	Cont.
18.2.2.1 The body of flare pilot manual isolation valves in the valve train of flare pilots and flame front generators shall not be constructed of material with a melting point less than 2012°F (1100 °C). **Note:** *Materials with melting point less than 2012°F (1100 °C) include aluminum, brass, bronze. copper, lead and plastic.*	**New**	Cont.
18.2.2.2 Flare pilot manual isolation valves shall be approved for use with gas and of a design that prevents the valve from being accidently opened or closed. These valves shall not be subjected to either a temperature, a pressure or a fluid-material compatibility outside of their approved rated range. **Note***: Design of the valve that prevents the valve from being accidently opened or closed can be achieved by administrative controls.*	**New**	Cont.

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18.2.2.3 When a provincial or territorial law, act, or regulation requires continuous flare pilot operation, flare pilot manual isolation valves shall be installed so that flare pilot valve train components can be maintained while at least one flare pilot remains in operation.	**New**	Cont.
18.2.3 Safety shut-off valves	**New**	Cont.
18.2.3.1 When a flare pilot is ignited by an automated flame front generator installed at ground level, with an input less than 20 000 Btu/h (6 kW), the automated flame front generator shall be equipped with at least one safety shut-off valve that is certified in accordance with ANSI Z21.21/CSA 6.5 or CSA 3.9.	**New**	Cont.
18.2.3.2 When a flare pilot is ignited by an automated flame front generator installed at ground level, with an input greater than 20 000 Btu/h (6 kW) up to and including 400 000 Btu/h (120 kW), the automated flame front generator shall be equipped with at least a) two safety shut-off valves piped in series and wired in parallel and certified in accordance with ANSI Z21.21/CSA 6.5; or b) one safety shut-off valve that is certified in accordance with ANSI Z21.21/CSA 6.5 and marked C/I or in accordance with CSA 3.9.	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
18.2.3.3 When a flare pilot is ignited by an automated flame front generator installed at ground level, with an input greater than 400 000 Btu/h (120 kW) up to and including 5 MM Btu/h (1025 kW), the automated flame front generator shall be equipped with at least a) two safety shut-off valves, in series both certified, one of which shall be certified in accordance with ANSI Z21.21/CSA 6.5 and marked C/I or certified in accordance with CSA 3.9; or b) one safety shut-off valve certified in accordance with ANSI Z21.21/CSA 6.5 and marked C/I or certified in accordance with CSA 3.9. The valve shall be equipped with a proof of closure switch that is interlocked in the starting circuit, and the holding circuit used in conjunction with the proof of closure shall not defeat the proof of closure switch.	**New**	Cont.
18.2.3.4 When a flare pilot is ignited by an automated flame front generator installed at ground level, with an input in excess of 5 MM Btu/h (1500 kW) and less than 12.5 MM Btu/h (3660 kW), the automated flame front generator shall be equipped with at least two safety shut-off valves in series, both certified in accordance with ANSI Z21.21/CSA 6.5 and marked C/I or certified in accordance with CSA 3.9. One safety shut-off valve shall be equipped with a proof of closure switch that is interlocked in the starting circuit, and the holding circuit used in conjunction with the proof of closure shall not defeat the proof of closure switch.	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
18.2.3.5 When a flare pilot is ignited by an automated flame front generator installed at ground level, with an input in excess of 12.5 MM Btu/h (3660 kW), the automated flame front generator shall be equipped with at least two safety shut-off valves in series, both certified in accordance with ANSI Z21.21/CSA 6.5 and marked C/I or certified in accordance with CSA 3.9. Each of the safety shut-off valves shall be equipped with a proof of closure switch that are interlocked in the starting circuit, and the holding circuit used in conjunction with the proof of closure shall not defeat the proof of closure switch.	**New**	Cont.
18.2.4 Automated valves When an automated flame front generator installed at the flare tip is used to ignite a flare pilot, an electrically operated valve certified to CSA 22.2 No.139 shall be installed. **Note:** *This electrically operated valve may be used to actuate a pneumatic valve.*	**New**	Cont.
18.2.5 Other valves	**New**	Cont.
18.2.5.1 When an enriching fuel is injected into process gases in accordance with Clause 18.1.5, a back check valve or other approved means to prevent backflow of process gas into the enriching fuel system shall be installed.	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
18.2.5.2 Remotely ignited flare pilot using compressed air shall be designed with back check valves or other approved means to prevent the flow of compressed air into the gas supply system, and flow of gas into the compressed air system.	**New**	Cont.
18.2.5.3 All valves downstream of the gas-air mixing element in a FFG shall be metal seated and rated for gas service.	**New**	Cont.
18.3 Fuel conditioning for flare pilots	**New**	Cont.
18.3.1 A flare pilot shall have a fuel conditioning device such as a strainer, filter, settling chamber, or knockout pot, installed in the valve train upstream of the pressure regulator.	**New**	Cont.
18.3.2 To allow the operator to determine if the fuel conditioning device installed in accordance with Clause 18.3.1 is functioning properly, an indicator or instrument shall be installed. **Note:** *the indicator or instrument will depend on the fuel conditioning device technology. A pressure or flow device will detect a plugged filter or strainer. A level device will detect a high level in a settling chamber or knockout pot.*	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
18.3.3 When a provincial or territorial law, act, or regulation requires continuous flare pilot operation, and all flare pilots are supplied by a common fuel valve train, a minimum of two fuel conditioning devices, in accordance with Clause 18.3.1, shall be installed in the common fuel valve train in parallel, to ensure that failure of any single fuel conditioning device does not result in the interruption of fuel to all flare pilots.	**New**	Cont.
18.4 Pressure regulators for flare pilots	**New**	Cont.
18.4.1 The fuel supply to a single flare pilot shall be regulated by a pressure regulator.	**New**	Cont.
18.4.2 A pressure indicator or instrument shall be installed downstream of the pressure regulator.	**New**	Cont.
18.4.3 Pressure regulators installed in accordance with Clause 18.4.1, shall be capable of maintaining an outlet pressure to within 20% above or below the regulator set pressure during flare pilot operation from minimum to maximum firing rates.	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
18.4.4 When a bypass line is installed on a flare pilot pressure regulator supplying a single flare pilot, to allow for maintenance while the flare pilot is still in operation: a) a fixed restriction orifice and needle or globe valve shall be installed in the bypass line to limit the gas flow and pressure to the maximum specified by the flare pilot manufacturer; b) flare pilot manual isolation valves, in accordance with Clause 18.2.2.2, shall: i) be installed upstream and downstream of the flare pilot pressure regulator to allow for proper isolation, ii) be normally open, and iii) be administratively controlled; c) a flare pilot manual isolation valve, in accordance with Clause 18.2.2.2, shall: i) be installed upstream of the orifice and needle or globe valve on the bypass line, ii) be normally closed, and iii) be administratively controlled; and d) use of the bypass shall be governed by procedure and limited to a maximum of 72 hours per maintenance activity.	**New**	Cont.
18.4.5 A bypass line shall not be installed on a on a flare pilot pressure regulator supplying multiple pilots.	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
18.4.6 When a provincial or territorial law, act, or regulation requires continuous flare pilot operation, and flare pilot(s) are supplied by a common fuel valve train, multiple pressure regulators shall be installed in parallel to ensure that failure of any single pressure regulator does not result in the interruption of fuel to all flare pilots. Flare pilot manual isolation valves, subject to Clause 18.2.2.2, shall be installed on either side of each pressure regulator to enable isolation of each flare pilot pressure regulator for maintenance. **Note:** *Parallel regulators can be set at staggered setpoints to avoid regulators fighting each other.*	**New**	Cont.
18.5 Overpressure protection devices for flare pilots	**New**	Cont.
18.5.1 Except as noted in Clause 18.5.2, a valve train component, accessory or flare pilot shall have a pressure rating not less than the protected inlet pressure to the component, accessory or flare pilot.	**New**	Cont.
18.5.2 When the protected inlet pressure exceeds the pressure rating of any downstream component, accessory or flare pilot, an overpressure protection device shall be provided, and set at a pressure which will not exceed the pressure rating of the lowest-rated component, accessory or flare pilot.	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
18.5.3 Overpressure protection shall be provided by any one of the following: a) monitoring regulator; b) overpressure relief device; c) series regulator; or d) overpressure shut-off device or OPCO device.	**New**	Cont.
18.5.4 If a relief valve is used, it shall be either an integral part of the regulator, or a separate line relief valve shall be installed as close as possible downstream from the regulator. A relief valve shall be capable of fully relieving the supply pressure in excess of the pressure rating of the lowest-rated component, accessory or flare pilot. A token overpressure relief device shall not be used as a full capacity overpressure relief device.	**New**	Cont.
18.5.5 When a monitoring or series regulator is used as an overpressure protection device, on a flare pilot, it shall comply with Clause 10.4.6.	**New**	Cont.
18.5.6 When a provincial or territorial law, act, or regulation requires continuous flare pilot operation, overpressure protection shall be provided by Clause 18.5.3 items a), b) or c).	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
18.6 Vents for flare pilot valve train components Vents for components in a valve train for a flare pilot shall be in accordance with Clauses 10.6.1, 10.6.2, 10.6.4, 10.6.5, 10.6.6, 10.6.7, 10.6.8, 10.6.9 and 10.6.10. In addition to the definition of a safe location referenced in Clauses 10.6.1 and 10.6.5, vents for components in a valve train for a flare pilot shall discharge to a location that is at least 10 ft (3m) from the manual shut-off valve required in Clause 18.2.1.2.	**New**	Cont.
18.7 Installation of flare pilots	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
18.7.1 The installation of a flare pilot, the method of installing the components of the valve train, and the piping and tubing materials shall be in accordance with the requirements of CSA B149.1, and methods to ensure that records pertaining to design specifications, installation, operation and maintenance instructions are provided to the owner of the equipment. As a minimum the following documentation shall be provided: a) description of any hazardous condition which may affect this flare pilot or its installation; b) process and Instrumentation Diagram (P&ID); c) bill of Materials (BOM) or component data sheets showing the model number, manufacturer, construction, materials, ratings and certification of each relevant component and its tag number referenced on the other drawings and on the physical component; d) wiring diagram; e) flare pilot automatic ignition system specification, if provided. f) operating narrative, shutdown key/cause and effect diagram, ladder logic, installation, operation, and maintenance manual or other suitable description of flare pilot operation; g) specification of electrical area classification (in compliance with the authority having jurisdiction), of the flare pilot and flare pilot automatic ignition system and instrument venting to a safe location, and overpressure protection of the fuel train; and h) for a flare pilot approved for use with different fuels, a switch-over procedure to be followed by the operator upon switching to another fuel without exceeding the maximum rating of the flare pilot.	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
18.7.2 Every hose and hose fitting shall comply with a) CAN/CSA 8.1; b) CSA 8.3; or c) CGA CR96.	**New**	Cont.
18.7.3 The piping, tubing and hoses used for the valve train to the flare pilot shall be protected from physical damage. Piping and tubing shall also be firmly secured and supported.	**New**	Cont.
18.7.4 An outdoor bleed vent or vent termination shall be equipped with a means to prevent the entry of water, insects, or foreign material.	**New**	Cont.
18.7.5 When a flame front generator installed at ground level is used to ignite a flare pilot, transmission piping shall be clearly labelled. Labels shall a) identify that piping may be hot and should not be touched, and b) be constructed of stainless steel.	**New**	Cont.
18.7.6 Piping and tubing materials of construction	**New**	Cont.

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18.7.6.1 Piping or tubing or other equipment located at grade for transporting the flare pilot gas shall not be constructed of material with a melting point less than 1100 °C. Hoses are excluded from this requirement and shall be installed in accordance with Clause 18.7.3. **Note***: Materials with melting point less than 1100 °C include aluminum, brass, bronze, copper, lead and plastic.*	**New**	Cont.
18.7.6.2 flame front generator transmission piping shall have a minimum wall thickness that will contain the pressure from a deflagration and/or detonation generated from FFG operation, as proven by declaration of conformance, in accordance with: a) NFPA 69, Chapter 13 Deflagration control by pressure containment, excluding Clause 13.3.4, Item 1, determination of maximum allowable working pressure allowing permanent deformation; or b) NFPA 67, Chapter 7, Detonation containment.	**New**	Cont.
18.7.6.3 Stainless steel FFG transmission piping design shall include a 0.0625 in (1.6 mm) allowance for erosion, as proven by declaration of conformance.	**New**	Cont.
18.7.6.4 Carbon steel FFG transmission piping design shall include at 0.125 in allowance covering both corrosion and erosion, as proven by declaration of conformance.	**New**	Cont.

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18.7.6.5 When FFG transmission piping includes threaded fittings: a) carbon steel piping less than 2 in NPS shall be at least Schedule 80; b) carbon steel piping 2 in NPS and greater shall be at least Schedule 40; c) stainless steel piping shall be at least Schedule 40S.	**New**	Cont.
18.7.7 Location	**New**	Cont.
18.7.7.1 The service clearance for a flare pilot shall be a minimum of 24 in (600 mm) to any structure or designed by the manufacturer to be removed, when service is required to be performed. When this distance is not sufficient for the removal, replacement, or repair of a component, an accessory, or any equipment forming an integral part of, or connected to, the flare pilot, a service clearance shall be provided that is adequate to effect such removal, replacement, or repair.	**New**	Cont.
18.7.7.2 A FFG installed at ground level that has potential to generate an unconfined flame that can present a hazard to the operator, shall be located in a managed restricted area with a minimum radial distance of 10 ft (3 m) from the source of the unconfined flame. The restricted area shall be clearly identified.	**New**	Cont.

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18.7.7.3 When a FFG is installed a) at ground level; and b) with transmission piping that is located in a hazardous location, as defined by the *Canadian Electrical Code, Part I,* at least one temperature safety device shall be installed on the transmission piping surface which shall disable the FFG on high temperature. The high temperature safety device will be set to ensure that when the FFG is in operation, the transmission piping surface does not exceed 25 °C less than the appropriate temperature class for the hazardous location(s).	**New**	Cont.
18.8 Ignition, instrumentation and alarming for flare pilots	**New**	Cont.
18.8.1 When a provincial or territorial law, act, or regulation requires continuous flare pilot operation, each flare pilot shall be equipped with at least one dedicated flare pilot automatic ignition system.	**New**	Cont.

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18.8.2 When a provincial or territorial law, act, or regulation requires continuous flare pilot operation, at least one dedicated means of flare pilot flame detection, capable of distinguishing between the flare pilot and flare tip flames, shall be installed. **Note:** *Commonly employed flare pilot flame detection systems include* *a) thermocouples;* *b) flame ionization detectors;* *c) optical systems (other than video cameras and monitors viewed by operators); and* *d) acoustic systems.*	**New**	Cont.
18.8.3 When a provincial or territorial law, act, or regulation requires continuous flare pilot operation, the flare pilot automatic ignition system installed as per Clause 18.8.1, shall a) continuously provide ignition on a fixed frequency; or b) intermittently provide ignition when the flare pilot indicates a loss of flame per Clause 18.8.2.	**New**	Cont.
18.8.4 When a provincial or territorial law, act, or regulation requires continuous flare pilot operation, a visual or audible information alarm shall activate within 15 min of detected loss of flame, to notify the operator of a flare pilot flame problem. The alarm shall be wired or programmed using a failsafe convention whereby loss of a signal or self-diagnosed instrument failure will generate the alarm.	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
18.8.5 When a provincial or territorial law, act or regulation requires continuous flare pilot operation, instrumentation and associated visual or audible information alarming shall be installed to notify the operator and enable diagnostics of flare pilot components, including but not limited to a) fuel conditioning device(s) per Clause 18.3.2; and b) fuel pressure regulator(s) per Clause 18.4.2. The alarm shall be wired or programmed using a failsafe convention whereby loss of a signal or self-diagnosed instrument failure will generate the alarm.	**New**	Cont.
18.9 Management systems	**New**	Cont.
18.9.1 When a provincial or territorial law, act, or regulation requires continuous flare pilot operation, a documented management system shall exist for flare pilot(s) including, but not limited to: a) procedures including event logs for i) operator response to loss of flame information alarms per Clause 18.8.4, describing re-ignition of flare pilot(s) in the event of loss of flame of one or more flare pilot(s); ii) operator response to information alarms per Clause 18.8.5; b) training on flare pilot operation and procedures; and c) on-going inspection and maintenance requirements for a flare pilot(s).	**New**	Cont.

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18.9.2 When there are no provincial or territorial laws, acts, or regulations that require continuous flare pilot operation, a documented management system shall exist for flare pilot(s) including, but not limited to a) procedures for: i) manual ignition and re-ignition of flare pilot(s) in the event of loss of flame on one or more flare pilot(s); ii) emergency procedures for re-ignition of the flare in the event of a total loss of flame on all flare pilots; b) training on flare pilot operation and procedures; and c) on-going inspection and maintenance requirements for a flare pilot(s).	**New**	Cont.
18.9.3 Event log and training record retention period shall be 5 years or in accordance with the authority having jurisdiction.	**New**	Cont.

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19 Appliances in a complex and integrated facility Requirements for an appliance in a complex and integrated facility shall: a) include requirements contained in Clauses 4, 5, 6, 7, 8,10, 11, 12, 13, 16, 17, 18, and 20; or b) be determined using an approved risk-based program (see Annex I for an example risk-based program compliant with IEC 61511). Where required by the authority having jurisdiction, the plan to proceed with the use of Clause 19 b) shall be approved prior to developing the risk-based program. In any case, the requirements contained in Clauses 1, 2, 3, 9, 14 and 15 shall apply.	**New**	To address the need for facility operators in the oil refining and petrochemical industries to protect both people in their facilities and the public located near those facilities from appliance related hazards while: • maintaining a high level of appliance reliability to reduce risk associated with false burner management system trips; • maintaining a high level of appliance availability (i.e., the appliance is operated for years between planned shutdowns) to reduce risk associated with production outages; and • to promote risk reduction where fully upgrading to prescriptive requirements may not be reasonable or practicable; Due to the highly integrated nature of oil refining and petrochemical facilities, prescriptive requirements may translate into more frequent appliance BMS trips which cause unplanned shutdown and restarting of entire process units which not only increases appliance related risk but also increases overall facility risk. The validity of the performance based approach depends upon the ability of the safety management system to ensure that risk is reduced to the point of ALARP (As Low As Reasonably Practicable) or acceptable and not the specific design of the appliance. Thus, the performance based approach is valid for all appliance types in a complex and integrated facility.

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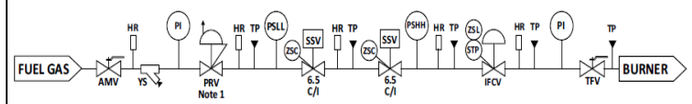
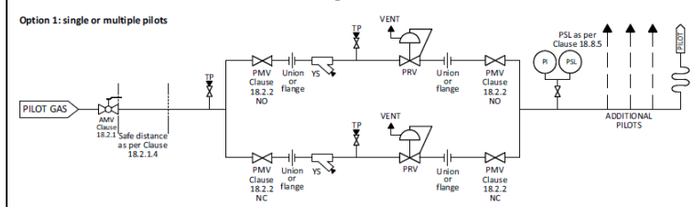
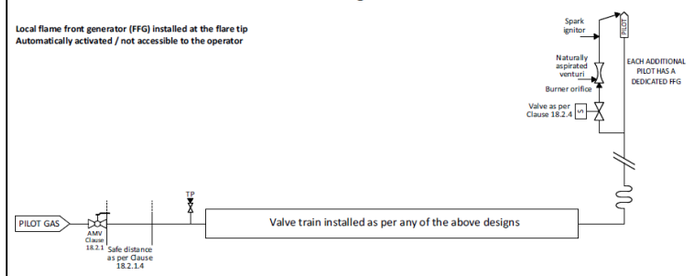
20 Additional requirements for portable appliances and equipment	**New**	Annex J – Food Trucks was expanded to include portable equipment and appliances as the B149.3 code was written for stationary type equipment.
20.1 Portable appliances and portable equipment shall be approved see Annex J for guidelines on mobile food service equipment (food trucks).	**New**	Cont.
20.2 Portable appliances and portable equipment shall be clearly marked as being portable.	**New**	Cont.
20.3.1 Instructions for (re)-assembly, commissioning, operation, decommissioning, disassembly and transportation of the portable appliance and portable equipment shall be approved	**New**	Cont.
20.3.2 A check list for the activities listed in Clause 20.3.1 shall a) be created; b) be dated and completed each time the portable appliance or portable equipment is relocated; c) identify the person(s) performing the work; and d) be kept with the portable appliance or portable equipment.	**New**	Cont.
20.4 A portable appliance or portable equipment shall not be used in one location longer than the approved time period.	**New**	Cont.
20.5 Vent lines such as those from vent valves, relief valves, regulator vents, pressure limit sensors, or other controls shall be an integral part of the portable appliance or portable equipment, or shall be field installed in accordance with B149.1.	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
Annex B (informative) **Valve diagrams**		
Figure B.9 Liquid propane valve train 	**New**	liquid propane valve train diagram were added in support of Clause 9 Additional requirements for liquid propane valve trains.
Figure B.10 a) Flare pilot valve trains 	**New**	Flare pilot valve trains diagrams were added in support of Clause 18 Flare pilots See Figure B.10 b), and c) for more examples.
Figure B.11 a) Flame front generators 	**New**	Flame front generator diagrams were added in support of Clause 18 Flare pilots See Figure B.11 b), c), d), e), f), and g) for more examples.

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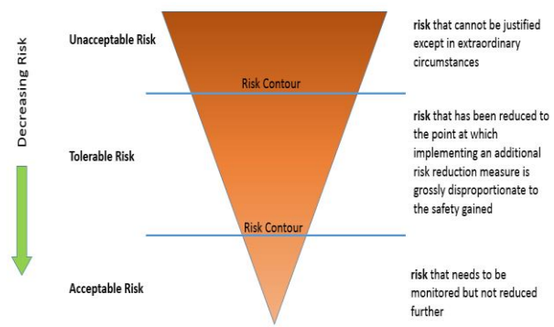
Annex I (informative) ***Risk based program for determining requirements for an appliance in a complex and integrated facility*** **Note:** *This Annex is not a mandatory part of this Code. However, it is written in mandatory language to accommodate adoption by the* authority having jurisdiction.	**New**	To address the need for facility operators in the oil refining and petrochemical industries to protect both people in their facilities and the public located near those facilities from appliance related hazards while: • maintaining a high level of appliance reliability to reduce risk associated with false burner management system trips; • maintaining a high level of appliance availability (i.e., the appliance is operated for years between planned shutdowns) to reduce risk associated with production outages; and • to promote risk reduction where fully upgrading to prescriptive requirements may not be reasonable or practicable; Due to the highly integrated nature of oil refining and petrochemical facilities, prescriptive requirements may translate into more frequent appliance BMS trips which cause unplanned shutdown and restarting of entire process units which not only increases appliance related risk but also increases overall facility risk. The validity of the performance based approach depends upon the ability of the safety management system to ensure that risk is reduced to the point of ALARP (As Low As Reasonably Practicable) or acceptable and not the specific design of the appliance. Thus, the performance based approach is valid for all appliance types in a complex and integrated facility.
I.1 Scope	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
I.1.1 This Annex describes a risk based program for determining requirements for fuel-related components and accessories and their assembly on an appliance, downstream of the manual shut-off valve specified in Clause 6.18.2 of CSA B149.1, necessary to maintain an appliance in a complex and integrated facility in a safe state.	**New**	Cont.
I.1.2 This Annex applies to an appliance in a facility where federal, provincial or municipal legislation allows for the auditing of on-going inspection, maintenance and testing activities.	**New**	Cont.
I.1.3 This Annex applies a) to an appliance with four or more burners in which flue gas comes into contact with the outside of a tube through which heat is transferred to the process load being heated inside the tube; or b) to an appliance in which a load (e.g., waste gas) is combusted.	**New**	Cont.
I.1.4 This Annex does not apply a) to an appliance in which flue gas comes into direct contact with the process load being heated; or b) to radiant-tube appliances.	**New**	Cont.
I.2 Definitions The following definitions shall apply to this Annex.	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
ALARP (as low as reasonably practicable) – the point at which implementing an additional risk reduction measure is grossly disproportionate to the safety gained (see Figure I.1). **Figure I.1** The **ALARP** principle  	**New**	Cont.
Engineer – a person who is licensed or otherwise authorized by a provincial or territorial engineering association to provide engineering services to the public.	**New**	Cont.
Facility operator — a person, company, or organization that is responsible for the operations of a facility or worksite, or who has the responsibility for a hazardous material or hazardous energy in a facility. **Note:** *The facility operator might not be the owner of the facility or worksite.*	**New**	Cont.

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Good practice – the recognized risk management practices and measures, as defined on the day that an appliance was installed, that are used by competent organizations to manage well understood hazards arising from the startup and operation of an appliance. **Notes:** 1) *API 534 (an industry overlay to NFPA 85) describes good practice for heat recovery steam generators in oil refineries and petrochemical facilities.* 2) *API 538 (an industry overlay to NFPA 85) describes good practice for boilers in oil refineries and petrochemical facilities.* 3) *API 556 describes good practice for fired heaters in oil refineries and petrochemical facilities.* 4) *API 561 (an industry overlay to API 556) describes good practice for steam methane reforming furnaces in oil refineries and petrochemical facilities.* 5) *API 565 describes good practice for sulfur plant reaction furnaces in oil refineries and petrochemical facilities.* 6) *NFPA 85 describes good practice for boilers.* 7) *NFPA 69 and NFPA 86 describes good practice for incinerators.*	**New**	Cont.
Hazardous scenario — a sequence of events, including event relationships (e.g., linkages and interdependencies), that starts with an initiating event and ends in one or more fatalities.	**New**	Cont.
Light-off cycle — the stage in the operating sequence of the appliance where a fuel source, air source, and ignition source are introduced into the combustion chamber to initialize the combustion process.	**New**	Cont.
Normal operating cycle — the stage where a stable controlled combustion process is used for a defined purpose.	**New**	Cont.

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Post-firing cycle (semi-automatic appliance control system or automatic appliance control system only) — the stage in the operating sequence which leaves the appliance in a safe state for operating personnel to attend to the appliance and prepare for the pre-firing cycle or an extended shutdown.	**New**	Cont.
Pre-firing cycle — the stage in the operating sequence which prepares the appliance for the safe introduction of fuel into the combustion chamber and the safe introduction of an ignition source.	**New**	Cont.
Risk — an incident expressed in terms of the annual likelihood of the incident occurring as a result of a hazardous scenario. **Acceptable risk** – risk that needs to be monitored but not necessarily further reduced. **Tolerable risk** – risk that has been reduced to ALARP. **Unacceptable risk** – risk that cannot be justified except in extraordinary circumstances. **Risk reduction measure** – a measure that reduces the risk from a hazard.	**New**	Cont.
Safe state — state of the process when safety is achieved *. **IEC 61511-1 (2016), Clause 3.2.67*	**New**	Cont.
Safety — freedom from unacceptable risk* **IEC 61511-1 (2016), Clause 3.2.68.*	**New**	Cont.
Stable operating range — any air/fuel ratio that results in complete combustion.	**New**	Cont.

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Stakeholder — individual or organization that can, or believe they can, be affected by the facility's operations or who are involved with assisting or monitoring facility operation.	**New**	Cont.
I.3 Quality management system (QMS)	**New**	Cont.
I.3.1 The facility operator shall develop and implement a QMS, including a management of change process, per CAN/CSA-ISO 9001 and IEC 61511-1, Clauses 5 through 7 dedicated to ensuring consistent implementation of the risk based program for determining requirements for fuel-related components and accessories and their assembly on an appliance, downstream of the manual shut-off valve specified in Clause 6.18.2 of CSA B149.1, in a complex and integrated facility.	**New**	Cont.
I.3.2 Before developing and implementing a QMS, the facility operator shall contact the authority having jurisdiction and seek pre-approval to proceed.	**New**	Cont.
I.3.3 The following items shall be included in and managed using the QMS: a) team competence; b) risk based process; c) on-going inspection, testing and maintenance programs; and d) a list of requirements.	**New**	Cont.
I.4 Team competence	**New**	Cont.

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I.4.1 The facility operator shall ensure that the team of at least three competent personnel that implement the risk based process for determining requirements for fuel-related components and accessories and their assembly on an appliance, downstream of the manual shut-off valve specified in Clause 6.18.2 of CSA B149.1, in a complex and integrated facility includes the following: a) one or more team members who are engineers; b) one or more team members who are trained to perform analysis, design, realization, operation, and maintenance activities for safety instrumented systems and have a valid expert or practitioner level credential in functional safety for the process industries sector issued by exida, ISA, TÜV Rheinland, TÜV SÜD or an approved body; c) one or more team members who have a minimum of 5 years' experience in the operation of the appliance type; d) one or more team members who have a minimum of 5 years' experience in the maintenance of the appliance type; e) one or more team members who have a minimum of 5 years' experience in process engineering and/or operations engineering for the process the appliance type is being added to; f) one or more team members who have a minimum of 5 years' experience as a subject matter expert for the appliance type; g) one or more team members who have a minimum of 5 years' experience as a subject matter expert for instrumentation for the appliance type; h) one or more team members who have a minimum of 5 years' experience as a subject matter expert for control systems for the appliance type; i) one or more team members who have a minimum of 5 years' experience as a subject matter expert for protective functions for the appliance type. Cont.	**New**	Cont.

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Notes: *1) The intent of this requirement is to ensure that the team possesses the required knowledge and expertise to design a system that will reduce risk associated with the appliance to ALARP.* *2) This competency aspect of the requirement also implies that the team possesses sufficient leadership skill and knowledge relating to the tools and techniques being utilized to properly analyze and mitigate the hazards associated with the appliance.*	**New**	Cont.
1.4.2 The authority having jurisdiction, the agent of the authority having jurisdiction, and the designer of the appliance shall be invited to participate in team activities but shall not be counted for the purpose of fulfilling the requirements of Clauses 1.4.1 a) through i).		
I.5 Risk based process	**New**	Cont.
I.5.1 Hazardous scenario identification	**New**	Cont.
I.5.1.1 The team of competent personnel shall identify and document the hazardous scenarios associated with the appliance per IEC 61511-1, Clause 8.2.1. The document shall include a description of the scenario pathway from an initiating event to a consequence(s) including event relationships (e.g., linkages and interdependencies).	**New**	Cont.
I.5.1.2 At a minimum, the pre-firing cycle, light-off cycle, normal operating cycle, and post-firing cycle hazardous scenarios listed in Table I.1 shall be included in the list of hazardous scenarios identified by the team of competent personnel.	**New**	Cont.

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I.5.1.3 Before proceeding to consequence analysis, the team of competent personnel shall contact the authority having jurisdiction, or their agent. At this time, the authority having jurisdiction, or their agent, may add hazardous scenarios to the list of hazardous scenarios identified by the team of competent personnel.	**New**	Cont.
I.5.2 Consequence analysis The team of competent personnel shall identify, analyze and document the potential consequences for the identified hazardous scenarios per IEC 61511-1, Clause 8.2.1. The consequence analysis shall consider a) the impacts on people; b) the combined effects of all released materials for a particular scenario; and c) applicable effects that cause other effects to happen.	**New**	Cont.
I.5.3 Likelihood analysis The team of competent personnel shall assess and document the likelihood of the consequences of the identified hazardous scenarios per IEC 61511-1, Clause 8.2.1. The likelihood analysis shall consider a) both internal and external events; and b) equipment and process control failures, and human error.	**New**	Cont.
I.5.4 Risk estimation The team of competent personnel shall estimate and document the risk for the identified hazardous scenarios.	**New**	Cont.

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I.5.5 Risk criteria	**New**	Cont.
I.5.5.1 The team of competent personnel shall establish and document the risk criteria for the appliance used to categorize risk as a) unacceptable risk; b) tolerable risk; or c) acceptable risk.	**New**	Cont.
I.5.5.2 The line between the unacceptable risk and tolerable risk criteria for the appliance shall align with criteria for the same established for other equipment inside the operating facility. When the line between unacceptable risk and tolerable risk criteria have not been established for other equipment inside the operating facility, the line between unacceptable risk and tolerable risk for the appliance shall be extrapolated from the land use risk contours shown in Figure I.2. The line between tolerable risk and acceptable risk shall be a single order of magnitude less than the line between unacceptable risk and tolerable risk.		

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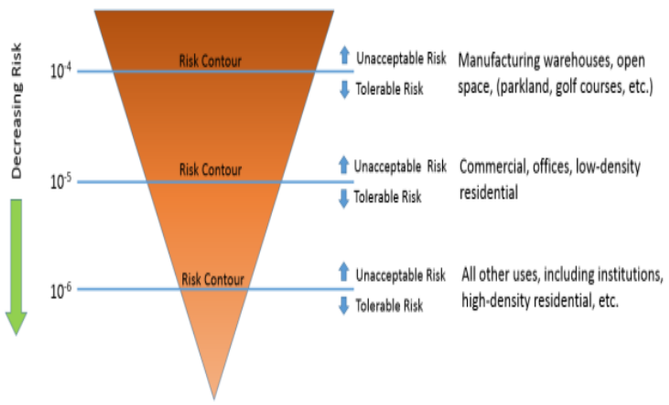
Figure I.2 **Land use risk contours** (See Clause I.5.5.2.)  **Note:** *Adapted from data provided in "Hazardous Substances Risk Assessment: a Mini-Guide for Municipalities and Industry", Major Industrial Accidents Council of Canada, 1994*	**New**	Cont.

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I.5.6 Risk reduction The team of competent personnel shall reduce risk associated with the appliance per IEC 61511-1, Clause 8.2.1 through 8.2.3, 9, 11, through 15, and 15 through 18 as follows: a) where it exists, good practice, shall be documented and applied; b) after good practice has been applied, the remaining risk associated with each hazardous scenario shall be evaluated, categorized and documented as unacceptable, tolerable or acceptable; c) risk reduction measures shall be documented and applied to reduce risks that are deemed unacceptable to a level that is either in the tolerable region or is acceptable; d) for risks in the tolerable region, additional risk reduction measures shall be documented and applied until the risk is ALARP; e) once risk is reduced to acceptable, this fact shall be documented and additional risk reduction measures shall not be required; f) the requirements for any component required to reduce risk shall be documented.	**New**	Cont.
I.5.7 New components	**New**	Cont.
I.5.7.1 When a risk reduction measure requires the installation of a new component listed in Table I.2, a) the component shall be certified to the corresponding standard in Table I.2 if the requirements for the component can be met using a component certified to that standard; b) if the component is a commercial/industrial safety shut-off valves per Clause 3 of ANSI Z21.21/CSA 6.5, the component shall be marked C/I.	**New**	Cont.

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I.5.7.2 When a risk reduction measure requires the installation of a new electrical or electronic component not listed in Table I.2, the component shall bear the certification marking as being certified to a Canadian standard or be approved.	**New**	Cont.
I.6 On-going inspection, testing and maintenance programs	New	Cont.
I.6.1 On-going inspection program The facility operator shall prepare and implement procedures, schedules, and record retention policies for the on-going inspection of fuel-related components and accessories on the appliance per IEC 61511-1, Clause 16. **Notes:** *The purpose of on-going inspection is to reveal incipient failures of fuel-related components and accessories on the appliance prior to a failure occurring and causing an impact. The facility operator may use applicable manufacturers' recommendations, industry standards or codes, good engineering practices, or prior operating experience to develop appropriate on-going inspection procedures and on-going inspection schedules.*	New	Cont.

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I.6.2 Testing program The facility operator shall prepare and implement procedures, schedules, and record retention policies for the testing of fuel-related components and accessories on the appliance per IEC 61511-1, Clause 16. **Notes:** *The purpose of testing is to reveal potentially dangerous undetected failures of fuel-related components and accessories on the appliance that will prevent them from responding appropriately to a true process demand.* *The facility operator may use applicable manufacturers' recommendations, industry standards or codes, good engineering practices, or prior operating experience to develop appropriate test procedures and test schedules.*	**New**	Cont.
I.6.3 Maintenance program The facility operator shall prepare and implement procedures, schedules, and record retention policies for the maintenance of fuel-related components and accessories on the appliance per IEC 61511-1, Clause 16. **Note:** *The facility operator may use applicable manufacturers' recommendations, industry standards or codes, good engineering practices, or prior operating experience to develop appropriate maintenance procedures and maintenance schedules.*	**New**	Cont.

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I.6.4 Employee training The facility operator shall train, or cause to be trained, each employee involved in implementing the on-going inspection, testing or maintenance procedures developed under Clause I.6.1, I.6.2 or I.6.3. Each such employee shall be trained in the hazards of the process, in how to avoid or correct unsafe conditions, and in the procedures applicable to the employee's job tasks.	**New**	Cont.
I.6.5 Third party employee training Any third party company involved in implementing the on-going inspection, testing or maintenance procedures developed under Clause I.6.1, I.6.2 or I.6.3 shall train, or cause to be trained, each of that company's employees involved in implementing the same. Each such employee shall be trained in the hazards of the process, in how to avoid or correct unsafe conditions, and in the procedures applicable to the employee's job tasks.	**New**	Cont.
I.7 List of requirements	**New**	Cont.
I.7.1 The team of competent personnel shall assemble a list of requirements, including those covered by IEC 61511-1, Clause 10 and 19, for fuel-related components and accessories and their assembly, downstream of the manual shut-off valve specified in Clause 6.18.2 of CSA B149.1, for the specific appliance assessed using the risk based process described in Clause I.5.	**New**	Cont.

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I.7.2 The list of requirements shall include the list of risk reduction measures determined under Clause I.5 in addition to the requirements of Clause 2, 3, 6, 11 and 12.	**New**	Cont.
I.7.3 The list of requirements shall include a requirement for assembling the following documentation: a) on-going inspection, testing and maintenance procedures determined under Clauses I.6.1, I.6.2 and I.6.3; b) on-going inspection, testing and maintenance schedules determined under Clauses I.6.1, I.6.2 and I.6.3; c) on-going inspection, testing and maintenance record retention policies determined under Clauses I.6.1, I.6.2 and I.6.3; and d) documentation of completion of the training required under Clauses I.6.4 and I.6.5.	**New**	Cont.
I.7.4 For newly installed appliances, a requirement for assembling the following documentation shall be present in the list of requirements: a) appliance specific information including a description of any hazardous condition which may affect this appliance or its installation, design specifications, operating narrative, control narrative, logic solver narrative, process and instrumentation diagram, shutdown key/cause and effect diagram, installation manual, and operation manual; b) material specifications for piping and tubing; c) electrical area classification and updated wiring diagram(s); and d) design specification for the overpressure protection of the fuel train	**New**	Cont.

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I.7.5 When upgrading of an existing certified or non-certified appliance is required, the list of requirements shall require that the following appliance specific documentation be reviewed and updated as necessary to keep the documentation current: a) appliance specific information including a description of any hazardous condition which may affect this appliance, design specifications, operating narrative, control narrative, logic solver narrative, process and instrumentation diagram, shutdown key/cause and effect diagram, installation manual, and operation manual; b) material specifications for piping and tubing; c) electrical area classification and updated wiring diagram(s); and d) design specification for the overpressure protection of the fuel train.	**New**	Cont.
I.7.6 For newly installed components or accessories, the list of requirements shall require assembly of the following documentation: a) Component-specific design specifications, installation, and operation; and b) Accessory-specific design specifications, installation, and operation.	**New**	Cont.
I.7.7 An accredited third party conformity assessment body shall verify that the list of requirements was determined by implementation of the risk based program per the terms of the QMS, or the list of requirements shall be approved.	**New**	Cont.

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Table I.1
List of hazardous scenarios involving an explosion that, at a minimum, shall be assessed (See Clause I.5.1.2.)

Item Number	Phase	Initiating Event	Potentially Detectable Abnormal Condition	Enabling Event Leading to Formation and/or Deflagration or Detonation of Combustible Mix
1	**Pre-Firing Cycle Post-Firing Cycle**	Combustibles leak from process tubes into **combustion chamber**	Combustibles present in **combustion chamber**	Air/fuel mixture exposed to hot surface
2	**Pre-Firing Cycle Post-Firing Cycle**	Combustibles leak from **pilot** train into **combustion chamber**	Combustibles present in **combustion chamber** Pilot train **valves** not in correct position	Air/fuel mixture exposed to hot surface
3	**Pre-Firing Cycle Post-Firing Cycle**	Combustibles leak from fuel train into **combustion chamber**	Combustibles present in **combustion chamber** Fuel train **valves** not in correct position	Air/fuel mixture exposed to hot surface
4	**Pre-Firing Cycle Post-Firing Cycle**	Combustibles leak from waste fuel train into **combustion chamber**	Combustibles present in **combustion chamber** Fuel train **valves** not in correct position	Air/fuel mixture exposed to hot surface

New

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5	**Pre-Firing Cycle Post-Firing Cycle**	External vapor cloud sucked into the **appliance**	Combustibles present in **combustion chamber**	Air/fuel mixture exposed to hot surface
6	**Light-Off Cycle**	Combustibles leak from process tubes into **combustion chamber**	Combustibles present in **combustion chamber**	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface
7	**Light-Off Cycle**	Pilot train **valves** opened prior to **ignition source** being present	Combustibles present in **combustion chamber** Pilot train **valves** not in correct position	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface
8	**Light-Off Cycle**	**Ignition source** does not light **pilot** gas within **trial-for-ignition period**	Combustibles present in **combustion chamber** Lack of **pilot** flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame
9	**Light-Off Cycle**	Pilot gas pressure increases above **stable operating range** of **pilot**	High **pilot** gas pressure Combustibles present in **combustion chamber** Lack of **pilot** flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame

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10	**Light-Off Cycle**	Pilot gas pressure decreases below **stable operating range** of **pilot**	Low **pilot** gas pressure Combustibles present in **combustion chamber** Lack of **pilot** flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame		
11	**Light-Off Cycle**	Pilot air pressure increases above **stable operating range** of **pilot**	High **pilot** air pressure Combustibles present in **combustion chamber** Lack of **pilot** flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame		
12	**Light-Off Cycle**	Pilot air pressure decreases below **stable operating range** of **pilot**	Low Pilot air pressure Combustibles present in **combustion chamber** Lack of **pilot** flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame		
13	**Light-Off Cycle**	Pilot gas composition moves outside **stable operating range** of **pilot**	Pilot gas density not within **stable operating range** of **pilot** Combustibles present in **combustion chamber** Lack of **pilot** flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame		

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14	**Light-Off Cycle**	Fuel train **valves** opened prior to **ignition source** being present	Combustibles present in **combustion chamber** Fuel train **valves** not in correct position	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface
15	**Light-Off Cycle**	**Ignition source** does not light fuel within **trial-for-ignition period**	Combustibles present in **combustion chamber** Lack of **burner** flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame
16	**Light-Off Cycle**	Fuel pressure increases above **stable operating range** of **burner**	High fuel pressure Combustibles present in **combustion chamber** Lack of **burner** flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame
17	**Light-Off Cycle**	Fuel pressure decreases below **stable operating range** of **burner**	Low fuel pressure Combustibles present in **combustion chamber** Lack of **burner** flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame
18	**Light-Off Cycle**	Main combustion air flow increases above **stable operating range** of **burner**	High main combustion air pressure or flow Combustibles present in **combustion chamber** Lack of **burner** flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame

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19	**Light-Off Cycle**	Main combustion air flow decreases below **stable operating range** of **burner**	Low main combustion air pressure or flow Combustibles present in **combustion chamber** Lack of **burner** flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame
20	**Light-Off Cycle**	Fuel composition moves outside **stable operating range** of **burner**	Fuel density not within **stable operating range** of **burner** Combustibles present in **combustion chamber** Lack of **burner** flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame
21	**Light-Off Cycle**	Waste fuel train **valves** opened prior to **ignition source** being present	Combustibles present in **combustion chamber** Waste fuel train **valves** not in correct position	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface
22	**Light-Off Cycle**	**Ignition source** does not light waste fuel within **trial-for-ignition period**	Combustibles present in **combustion chamber** Lack of waste fuel flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame

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23	**Light-Off Cycle**	Waste fuel pressure increases above **stable operating range**	High waste fuel pressure Combustibles present in **combustion chamber** Lack of waste fuel flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame
24	**Light-Off Cycle**	Waste fuel pressure decreases below **stable operating range**	Low waste fuel pressure Combustibles present in **combustion chamber** Lack of waste fuel flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame
25	**Light-Off Cycle**	Waste fuel composition moves outside **stable operating range** of vent	Waste fuel density not within **stable operating range** of vent Combustibles present in **combustion chamber** Lack of waste fuel flame acknowledgment	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface or flame
26	**Light-Off Cycle**	External vapor cloud sucked into the **appliance**	Combustibles present in **combustion chamber**	Main combustion air flow reduced below the rate necessary to prevent fuel from accumulating to the point of explosion **Ignition** attempt Air/fuel mixture exposed to hot surface
27	**Normal Operating Cycle**	Combustibles leak from process tubes into **combustion chamber**	Combustibles present in **combustion chamber**	Combustion air flow rate increased Tramp air flow rate increased Air/fuel mixture exposed to hot surface or flame

New

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28	**Normal Operating Cycle**	Fuel pressure increases above **stable operating range** of **burner**	High fuel pressure Combustibles present in **combustion chamber** Lack of **burner** flame acknowledgment Flue gas temperature changes	Fuel flow quickly decreased Combustion air flow rate increased Tramp air flow rate increased Air/fuel mixture exposed to hot surface or flame	**New**	Cont.
29	**Normal Operating Cycle**	Fuel pressure decreases below **stable operating range** of **burner**	Low fuel pressure Lack of **burner** flame acknowledgment Flue gas temperature changes	Loss of flame, **combustion chamber** cools, fuel controller increases fuel flow Air/fuel mixture exposed to hot surface or flame		
30	**Normal Operating Cycle**	Main combustion air flow decreases below **stable operating range** of **burner**	Low main combustion air pressure or flow Combustibles present in **combustion chamber** Lack of **burner** flame acknowledgment Flue gas temperature changes	Fuel flow quickly decreased Combustion air flow rate increased Tramp air flow rate increased Air/fuel mixture exposed to hot surface or flame		
31	**Normal Operating Cycle**	Fuel composition moves outside **stable operating range** of **burner**	Fuel density not within **stable operating range** of **burner** Combustibles present in **combustion chamber** Lack of **burner** flame acknowledgment Flue gas temperature changes	Fuel flow quickly decreased Combustion air flow rate increased Tramp air flow rate increased Air/fuel mixture exposed to hot surface or flame		

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32	**Normal Operating Cycle**	Waste fuel composition moves outside **stable operating range** of **burner**	Waste fuel density not within **stable operating range** of **burner** Combustibles present in **combustion chamber** Lack of **burner** flame acknowledgment Flue gas temperature changes	Fuel flow quickly decreased Combustion air flow rate increased Tramp air flow rate increased Air/fuel mixture exposed to hot surface or flame	**New**	Cont.
33	**Normal Operating Cycle**	Waste fuel pressure increases above **stable operating range**	High waste fuel pressure Combustibles present in **combustion chamber** Lack of waste fuel flame acknowledgment	Fuel flow quickly decreased Waste fuel pressure quickly decreased Combustion air flow rate increased Tramp air flow rate increased Air/fuel mixture exposed to hot surface or flame		
34	**Normal Operating Cycle**	Waste fuel pressure decreases below **stable operating range**	Low waste fuel pressure Combustibles present in **combustion chamber** Lack of waste fuel flame acknowledgment	Fuel flow quickly decreased Combustion air flow rate increased Tramp air flow rate increased Air/fuel mixture exposed to hot surface or flame		

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35	**Normal Operating Cycle**	Liquid or solid in the fuel restricts fuel flow	Low fuel flow High fuel pressure Combustibles present in **combustion chamber** High level in the fuel knockout drum Erratic **combustion chamber** pressure Lack of **burner** flame acknowledgment Loss of heat tracing on fuel line	Fuel flow quickly decreased Combustion air flow rate increased Tramp air flow rate increased Air/fuel mixture exposed to hot surface or flame		

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36 **Normal Operating Cycle** Combustible liquids mix with the fuel Oil dripping out of the bottom of the **appliance** Low fuel pressure Lack of **burner** flame acknowledgment Low main combustion air pressure or flow Combustibles present in **combustion chamber** Lack of **burner** flame acknowledgment Fuel density not within **stable operating range** of **burner** Combustibles present in **combustion chamber** Lack of **burner** flame acknowledgment Waste fuel density not within **stable operating range** of **burner** Combustibles present in **combustion chamber** Lack of **burner** flame acknowledgment Low fuel flow High fuel pressure Combustibles present in **combustion chamber** High level in the fuel knockout drum Erratic **combustion** Oil leaves heater and mixes with ambient air Combustion air flow rate increased Tramp air flow rate increased Air/fuel mixture exposed to hot surface or flame	**New**	Cont.

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			chamber pressure Lack of **burner** flame acknowledgment			
37	**Normal Operating Cycle**	**Combustion chamber** temperature drops below the temperature required for the **appliance** to remain within its **stable operating range**	**Combustion chamber** temperature Combustibles present in **combustion chamber** Lack of flame acknowledgment	Fuel flow quickly decreased Combustion air flow rate increased Tramp air flow rate increased Air/fuel mixture exposed to hot surface or flame	**New**	Cont.

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Table I.2
List of components and corresponding certification standards
(See Clause I.5.7)

Component	Certification Standard
automatic gas **ignition** systems; as defined in CSA CAN1-6.4; and **components** thereof other than types utilizing low, extra low, or high voltages, constructed entirely of new, unused parts and materials	CSA CAN1-6.4
automatic **valve**; as defined in ANSI Z21.21/CSA 6.5; constructed entirely of new, unused parts and materials	ANSI Z21.21/CSA 6.5
commercial/industrial **safety shut-off valve** as defined in ANSI Z21.21/CSA 6.5	ANSI Z21.21/CSA 6.5
elastomeric composite hose or hose coupling for conducting propane and natural gas	CAN/CGA-8.1
flexible metallic hose	CGA CR96
logic solver	IEC 61508
manual lever operated, pressure lubricated, straight way gas shut-off, quarter-turn, plug, ball, or eccentric type **valve** of metallic construction with weld and flanged and threaded ends	CSA 3.11
manual lever operated, gas shut-off, quarter-turn, plug, ball, or eccentric type **valve** of metallic construction, with weld and flanged and threaded ends other than pressure lubricated designs	CGA 3.16
manually-operated quarter-turn, plug, ball, or eccentric type gas **valve**, as defined in ANSI Z21.15/CSA 9.1, not exceeding 4 in (102 mm) pipe size	ANSI Z21.15/CSA 9.1
thermoplastic hose, hose coupling or complete assembly of hose and couplings used to conduct natural gas in a gaseous state and propane in either a liquid or gaseous state to be used at temperatures between -40°F (-40 °C) and 140°F (60 °C)	CAN1-8.3
transformer for oil- and gas-**burner ignition** equipment for potentials up to and including 600 V low potential, and 15,000 V open-circuit high-potential, designed to be employed in accordance with the rules of the Canadian Electrical Code, Part I	CSA C22.2 No. 13

New

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Annex J (informative) ***Mobile outdoor food service unit*** **Note:** *This Annex is not a mandatory part of this Code. However, it is written in mandatory language to accommodate adoption by the authority having jurisdiction*	**New**	Cont.
J.1 General: This Annex applies to mobile food service equipment commonly referred to as food trucks of the enclosed type (four walls, ceiling and floor). They can be either self-propelled or towed. Open style trailers and carts are not covered in these requirements as the ANSI-Z83.11*CSA-1.8 has provisions for approving them. These requirements cover or make reference to the entire fuel features of the enclosed truck / trailer including a) the storage of fuel; b) transmission of gas (piping / tubing); c) burning of gas; d) combustion air; and e) exhaust air. These requirements are not intended to approve individual appliances or components. The expectation is all appliances and components used will be certified and suitable for the application.	**New**	Cont.

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J.2 Definition The following definitions shall apply in this Annex: **Mobile outdoor food service unit** — a unit used outdoors for preparation and dispensing of food or beverages and that contains appliances or equipment operated by propane in the vapour state. The unit can be equipped with wheels and its own motive power. **Readily accessible** — capable of being operated quickly under duress, without requiring the operator of the device to a) use tools to assist in operation of the device; b) climb over an obstacle to operate the device; c) use a ladder, either portable or fixed, to operate the device; d) crawl or reach under an obstacle to operate the device; and e) remove obstacles to operate the device.	**New**	Cont.
J.3 Fuel Storage	**New**	Cont.
J.3.1 Clauses 5.2.1, 5.2.5 to 5.2.14, 5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.3.5.1, 5.3.5.2, 5.3.5.4 to 5.3.5.7, 5.3.6, 5.3.7, 5.3.8, 5.4.1, 5.4.2, 5.4.4 to 5.4.6, 5.4.8 to 5.4.13, 5.4.15, 5.5, and 5.6 from CSA B149.5 shall be complied with.	**New**	Cont.
J.3.2 All cylinders shall be secured by threaded brackets, or bolted carriers designed and fabricated to withstand calculated loading in any direction equal to at least eight times the weight of the cylinder when filled with propane.		Cont.

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J.4 Distribution of gas (piping/tubing)	**New**	Cont.
J.4.1 Clauses 5.1.2, 5.1.4, 5.7.1, 5.7.2.2 to 5.7.2.4, 5.7.3, 5.7.4, 5.7.5, 5.7.6.1 to 5.7.6.5, 5.7.7, 5.7.8.1 to 5.7.8.8, 5.7.9, 5.7.10.2 to 5.7.10.4, 5.8, 5.9, 5.10.1, 5.10.3, and 5.10.4 from CSA B149.5 shall be complied with.		Cont.
J.4.2.1 The following additional requirements specified in Clauses J.4.2.2 to J.4.2.7 shall be complied with.	**New**	Cont.
J.4.2.2 A manual shut-off valve shall be located downstream of the pressure regulator and upstream of all appliances, on the exterior of the vehicle in a readily accessible location adjacent to the gas supply.	**New**	Cont.
J.4.2.3 Each appliance shall be provided with a manual isolation valve.	**New**	Cont.
J.4.2.4 Appliances may be connected to the gas supply with black iron or steel piping, copper tubing, appliance connectors certified to ANSI Z21.24/CSA 6.10 or movable Appliance connectors certified to CSA 6.16 according to the requirements of CSA B149.1	**New**	Cont.
J.4.2.5 For vapour applications, not less than two-stage regulation shall be utilized on all permanent propane installations.	**New**	Cont.
J.4.2.6 Propane vapour, at a pressure not greater than 13 in w.c. (3.2 kPa), shall be supplied into the piping or tubing supplying any appliance.	**New**	Cont.

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J.4.2.7 Tubing shall be a) stainless steel tubing, 300 series; b) brass tubing conforming with ASTM B135; or c) copper tubing conforming to ASTM B88 of Type K or L; and d) rated for five times the design pressure of that location in the system	**New**	Cont.
J.4.2.8 The testing of piping, tubing, hose and fittings as specified in Clause 6.22.1 and Table 6.3 of CSA-B149.1 shall be complied with.	**New**	Cont.
J.5 Appliances	**New**	Cont.
J.5.1 All appliances used inside the equipment shall be of the certified type and installed in accordance to their certified instructions. This includes appliances certified to a) ANSI Z83.11/CSA-1.8; b) ANSI Z21.10.1/CSA-4.1; c) ANSI Z21.10.3/CSA 4.3; d) ANSI Z21.19/CSA-1.4; and e) ANSI Z21.47/CSA-2.3.	**New**	Cont.
J.5.2 A clearance of not less than 16 in (400 mm) shall be provided between a deep fat fryer and an open flame of an adjacent appliance unless a noncombustible divider extending not less than 7 in (175 mm) above the fryer and the open flame of the adjacent appliance is provided.	**New**	Cont.

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J.5.3 All appliances shall be secured by threaded brackets, or bolted carriers designed and fabricated to withstand calculated loading in any direction equal to at least four times the weight of the appliance.	**New**	Cont.
J.6 Combustion air supply and flue gas outlet	**New**	Cont.
J.6.1 A combustion air inlet or flue gas outlet of an appliance or any other vehicle opening shall be located at least 3 ft (1 m) from any engine filler spout or liquid-level gauge of the vehicle if the intake, outlet, or opening is located above or at the same level. If any portion of such inlet, outlet, or opening is located below the spout or fixed-liquid-level gauge, the clearance shall be the sum of the vertical distance below the spout or fixed-liquid-level gauge plus 3 ft (1 m).	**New**	Cont.
J.6.2 An open door may be used as an alternative means of providing combustion or ventilation air provided that the door is interlocked to the fuel supply to ensure that the door remains sufficiently open during appliance operation.	**New**	Cont.
J.6.3 All combustion air supply openings shall meet the requirements of Clause 8 from the CSA-B149.1.	**New**	Cont.
J.7 Exhaust hood and ventilation	**New**	Cont.

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J.7.1 The following applicable sections from Annex B of the NFPA-96 shall be complied with: a) B.1 General b) B.3 Duct Contact c) B.4 Hoods d) B.5 Grease Removal Devices in Hoods e) B.6 Exhaust Duct System f) B.7 Air Movement – 7.1.1 through 7.1.6, g) B.8 Auxiliary Equipment – 8.1 through 8.3 h) B.9 Fire-Extinguishing Equipment i) B.10 Solid Fuel Cooking Operations j) B.12 Carbon Monoxide Detectors k) B.13 Location of Mobile and Temporary Cooking Operations l) B.14 Tents m) B.16 Internal Combustion engine Power Sources n) B.17 Vehicle-Mounted Generators	**New**	Cont.
J.7.2 Mobile food service equipment (MFSE) which contains hydrocarbon fired appliances within an enclosed space shall have a mechanical exhaust system interlocked with the fuel supply line so that operation is permitted only when exhaust airflow is proven.	**New**	Cont.
J.8 Maintenance The equipment shall be subjected to maintenance and or inspection as required by the jurisdiction for which it is operated in.	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
J.9 Operation Manual An operation manual shall be supplied with the food truck **Note:** *Proof of training for the end user may be required for the local authority*	**New**	Cont.
J.10 Markings	**New**	Cont.
J.10.1 A general rating plate shall be affixed to the equipment containing the following information: Vehicle Identification number or equivalent a) type of fuel supplied to the appliances b) supply pressure of the fuel c) total input of all appliances, (Btu/h) d) maximum altitude, feet f) electrical rating – volts, amperage g) a list of all appliances including: i) manufacturer ii) model iii) type of equipment iv) input rate (Btu/h)	**New**	Cont.
J.10.2.1 The following warning labels Clauses J.10.2.2 to J.10.2.4) from CSA-B149.1 shall be complied with.	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
J.10.2.2 A durable label in both English and French made of a material that is not adversely affected by water, employing an adhesive that is not water soluble, and measuring not less than 4.5 × 5.75 in (100 × 125 mm) shall be provided. This label shall be located on the vehicle, adjacent to the propane container, and shall be worded as follows: a) in English: WARNING This system is designed for use with PROPANE only. DO NOT CONNECT NATURAL GAS TO THIS SYSTEM. Before turning on propane: • Be certain appliances are certified for propane and are equipped with correct burner orifices. • Make certain all propane connections have been made tight, all appliance valves are turned off, and any unconnected outlets are capped. After turning on propane: • Light all pilots. • Each connection, including those at appliances, regulators, and cylinders, shall be leak tested periodically with soapy water by the occupant. Never use a lighted match or other flame when checking for leaks. • Do not leave system turned on or containers connected until system has been proven to be propane-tight. • Cooking appliances must not be used for space heating. • When the containers are disconnected, the propane supply line must be capped or plugged.	**New**	Cont.

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b) in French: AVERTISSEMENT Cette installation est conçue pour fonctionner au PROPANE seulement. NE PAS ALIMENTER CETTE INSTALLATION AVEC DU GAZ NATUREL. Avant d'admettre le propane : • S'assurer que l'appareil est certifié pour fonctionner au propane et qu'il est muni des orifices de brûleur appropriés. • S'assurer que tous les raccordements sont étanches, que tous les robinets d'appareils sont fermés et que toutes les sorties non raccordées sont bouchées. Après avoir ouvert l'admission de propane : • Allumer toutes les veilleuses. • L'occupant doit s'assurer périodiquement, à l'aide d'eau savonneuse, qu'il n'y a aucune fuite aux points de raccordement des appareils, des régulateurs et des bouteilles. Ne jamais utiliser une allumette allumée ou toute autre flamme pour déceler une fuite. • Ne pas laisser le propane ni les récipients branchés avant de s'être assuré que l'installation ne présente aucune fuite de propane. • Ne pas utiliser des appareils de cuisson pour réchauffer une pièce. • Lorsque les récipients sont débranchés, la tuyauterie d'alimentation en propane doit être bouchée. The words "WARNING" and "PROPANE" and the phrase "DO NOT CONNECT NATURAL GAS TO THIS SYSTEM" (and their equivalents in French) shall be a minimum of 1/4 in (6.4 mm) in height, and the remainder of the wording shall be a minimum of 1/8 in (3.2 mm) in height. Note: *Equivalent instructions are to be provided when other fuel than propane is used.*	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
J.10.2.3 On all vehicles equipped with appliances, a durable label, made of material not adversely affected by water and employing an adhesive that is not water soluble, shall be provided in both English and French. This label shall be attached adjacent to any fuel-filling locations (gasoline, diesel, or NGV) and propane cylinders. The label shall be worded as follows: a) in English: WARNING Engine ignition and all appliance pilot lights shall be turned off before and during refueling of motor fuel tanks or any mounted propane container. b) in French: AVERTISSEMENT Couper le moteur et toutes les veilleuses des appareils avant et pendant le remplissage des réservoirs de carburant et de tout récipient de propane installé. The words “WARNING” and “AVERTISSEMENT” shall be a minimum of 1/4 in (6.4 mm) in height, and the remainder of the wording shall be a minimum of 1/8 in (3.2 mm) in height.	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
J.10.2.4 On all vehicles equipped with appliances, a durable label shall be provided in both English and French. This label shall be attached in a location in full view of the driver. The label shall be worded as follows: a) in English: WARNING All appliance pilot lights shall be turned off before and during vehicle movement. b) in French: AVERTISSEMENT Toutes les veilleuses des appareils avant et pendant le déplacement du véhicule. The words “WARNING” and “AVERTISSEMENT” shall be a minimum of 1/4 in (6.4 mm) in height, and the remainder of the wording shall be a minimum of 1/8 in (3.2 mm) in height.	**New**	Cont.
J.10.3 Adhesive labels shall be made from material that meets the requirements of CSA C22.2 No 0.15	**New**	Cont.

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
J.11 Testing This procedure has been developed as a guide when approving mobile food service equipment (food trucks) a) test fire each appliance while checking for smooth ignition, shut-down and good combustion; b) operate all appliances simultaneous with all doors and windows closed except openings designated as combustion air. Check for smooth operation and complete capturing of all flues gases by the exhaust hood This test will ensure the fixed air opening for combustion and ventilation air is adequate; c) all joints on the gas piping downstream of the appliance shutoff valve shall be leak tested; d) the gas piping for a vapour system shall be pressure tested in accordance to the CSA-B149.1; e) test the air flow proven device, switch or current sensor to ensure the fuel supply is terminated in the event the exhaust fan is not operating; f) test the interlock on door or window if permanent combustion air source is not provided; and g) a pressure drop test in the piping system shall be conducted with all appliances operating at full input rate. The amount of pressure drop shall not exceed the value specified in table 6.1 of CSA-B149-1.	**New**	Cont.
Annex K (informative) ***Recommended requirements for automatic safety shutoff valves and automatic vent valves installed on gas turbines having capacities greater than 12.5 MMBtu/h (3.66 MW) and inlet pressures greater than 150 psi*** **Note:** *This Annex is not a mandatory part of this Code.*		As referenced in Clause 17.3.5

DRAFT - CSA B149.3-2020	Current CAN/CSA-B149.3-15	Interpretations and Rationale
K.1 When using automatic valves handling inlet gas pressures over 150 psi and capacities greater than 12.5 MMBtu/h (3.66 MW), the valve should be approved for a given application. When approving a valve for this kind of application, the following performance requirements should be taken into consideration: a) the automatic valve should not incorporate a by-pass or an external means which prevents it from closing; b) pressure rating, temperature rating, and corrosion resistance; c) UV protection if installed outside; d) the automatic valve should not utilize fuel gas pressure/flow through the valve or an external power source for closure; e) the automatic valve should not have too slow a closing time that would adversely affects the safety of downstream equipment; f) the automatic valve should use elastomers resistant to the effects of the gas; and g) the automatic valve should comply with the following clauses in ANSI Z21.21/CSA 6.5: i) Clause 4.1. General requirements; ii) Clause 4.2 Equipment and data to be furnished by the manufacturer; iii) Clause 4.3, Assembly; iv) Clause 4.8, Materials; v) Clause 4.9, Instructions; and vi) Clause 5.4, Leakage (number of cycles, as declared by the automatic valve manufacturer, with which the automatic valve can comply; the recommended capability is 20 000 cycles). h) Closing times should be not more than 5 seconds		
END		